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STANDARD GRADING SPECIFICATIONS FOR YARD LUMBER.[1]

As Recommended by the Department of Agriculture.

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[1] The specific information on which this bulletin is based was collected during four years of study of this problem by the Forest Products Laboratory. Much of the material contained in it has been previously released for the use of various committees of lumbermen working on standardization of lumber grades, sizes, and nomenclature. The authors wish particularly to acknowledge their indebtedness to John A. Newlin, in charge Section of Timber Mechanics, Forest Products Laboratory, particularly for information in regard to the requirements of use of boards and dimension; to J. E. Jones, chief inspector, Southern Pine Association; to C. J. Hogue, manager, West Coast Forest Products Bureau; to Fred W. Alexander, secretary-manager, Pacific Lumber Inspection Bureau; to Dudley F. Holtman, construction engineer, National Lumber Manufacturers' Association; to J. McDonald, chief inspector, Northern Hemlock and Hardwood Manufacturers' Association; to E. F. Tobin, chief inspector, Western Pine Manufacturers' Association; to R. Patchin, chief inspector, Northern Pine Manufacturers' Association; to W. P. Johnson, formerly inspector for the California White and Sugar Pine Manufacturers' Association; to Joseph Brown, inspector, Southern Cypress Manufacturers' Association; to the owners and managers of the numerous sawmills at which studies have been made; to the secretaries and heads of the various associations of lumber manufacturers; and to the district forest officers of the United States Forest Service for the advice and cooperation which have made this circular possible.

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FOREWORD.

In the early development of any great industry there is always a diversity of methods, but as time goes on points of difference become less pronounced and points of similarity become more apparent. This change occurs gradually, usually through a process of economic selection. Before an industry can reach its highest development, however, unification of methods and products always occurs. In fact, standardization is a prerequisite to highest development.

This has been particularly true of the manufacture of lumber. Lumbering has ever been a pioneer industry, often preceding even agriculture. In each of the great timber-producing regions of the United States the lumberman has usually been the first to enter. He has found there diverse conditions which he was compelled to accept, yet he has always been able to suit his methods to the situation at hand. He has taken up inventions as they were brought out and has been quick to seize upon the best features of methods of manufacture already developed by others in the same or in different regions. The result has been considerable standardization of manufacturing methods throughout the lumber industry. Hand in hand with this has gone a partial unification of methods of distribution, but in both of these branches development is far from complete. There still exists ample opportunity and a real need for standardization of lumber products and shipping practices. This fact can best be brought out by a discussion of the wide diversity found in the lumber specifications now in use.

As many as two dozen different booklets have been issued by the various lumber manufacturing associations describing the grades of lumber which they produce. In addition, there are printed specifications of wholesalers, retailers, consuming factories, individual manufacturers, railroads, departments of the Federal Government, States, and cities, and the numerous unwritten specifications used by lumbermen who do not sell under the rules of organized associations. The situation is further complicated by the fact that some woods are graded under one set of rules in one locality and under different rules in the same or different territories.

The same situation exists in regard to the finished sizes of lumber. There is a multiplicity of sizes, even for material used for the same purpose. These differences are small, but their effect upon the use of lumber is large. Nonuniform sizes not only increase the cost of lumber, but they may also cause financial loss to the consumer and loss of good will to the manufacturer.

Grade names, as the grades themselves, vary according to associations, regions, individual manufacturers, and consumers. It has sometimes been considered that the standardization of grade names would remedy the existing situation. Certainly the standardization of names is important, but it would fail by a great margin to clarify existing conditions unless it was accompanied by standardization of the grade descriptions themselves.

The nomenclature of the common kinds of woods is in the same chaotic state as are grade names. A great deal of confusion and camouflage now prevails with respect to comparatively little known species. Much dissatisfaction with wood in general, resulting in

increased substitution of other materials, can be traced to confusion in present trade names for the various woods.

It is not surprising that this is true when it is realized that there are at least 600 different species of trees native to the United States, of which 100 are softwoods and 500 hardwoods. There are as many as 35 to 40 species of pine, about 70 species of oak, 12 species of fir, etc. Counting the overlapping of names, the 35 to 40 species of pine alone are known by about 300 common names, or an average of 8 names apiece. Longleaf pine is known by at least 29 local or generally used names, loblolly pine by 23, western soft pine by 21, and so on.

Little attention has ever been given the grade marking of lumber. Under existing conditions, a mark is usually placed on each piece of lumber or bundle of pieces to indicate the grade. The system is usually designed for rapidity in marking, however, and to distinguish lumber only at the mill without thought of assisting the consumer in recognizing the grade.

Lack of standardization with the resulting confusion is also apparent in shipping practices. The number of pieces in a bundle, responsibility for damage in transit due to improper bundling, percentages of different lengths and widths in orders covering random lengths and widths, percentage of each grade in shipments of material under combination grades, such as Merchantable or No. 2 Common and Better, percentage of each species permitted in shipments covering mixed species, moisture content of seasoned lumber, liability of the consumer for degrade on special orders, and permissible variation between graders are all examples of variations possible in existing shipping practices.

Considerable variation in association shipping weights for the same species of wood also exists.

That such wide variations in grades, sizes, nomenclature, grade marks, shipping practices, and weights exist can not be refuted. It is only necessary to scrutinize the grading rule books of different manufacturing and consuming associations to prove this point. It is clear, then, why an insistent demand for standardization exists among consumers, distributors, and manufacturers of lumber. Not only has this demand been given expression at several conferences of the industry as one of the largest issues with which it is confronted to-day, but the public in general is vitally interested from the standpoint of the saving of forest products made possible through wise standardization.

Timber is a product of the soil, and hence governmental activities as applied to the forests are vested in the Department of Agriculture. This department is instructed by legislative authority to conduct investigations which will tend to promote economy in the use of forest products.

As a result of a conference of lumber manufacturers, distributors, and consumers with the Department of Commerce in May, 1922, the softwood lumber interests went on record as favoring standardization of their lumber products within the industry itself, with the active assistance of various technical organizations and governmental agencies. This movement, which was in reality the outgrowth of earlier work toward these objectives by the American Lumber Con-

gress and the National Lumber Manufacturers' Association, brought about, in a subsequent conference, the creation of the Central Committee on Lumber Standards. This committee is now actively engaged in the work of promulgating lumber standards.

In accordance with the legislative authority vested in the Department of Agriculture to conduct investigations to promote economy in the use of forest products, the Forest Service is, therefore, with the support and cooperation of the Central Committee on Lumber Standards and other interested trade organizations, carrying on a comprehensive study of lumber standardization.

Four main divisions of the field of standardization are being considered: (1) Hardwood lumber, (2) softwood factory lumber, (3) structural timbers, and (4) yard lumber. A comprehensive survey of the manufacture and consumption of both hardwood factory lumber and softwood factory lumber is now under way. A publication containing basic grading rules for structural timbers based on strength is being issued as a companion to this circular. In this circular results of the study of the fourth division, in the form of proposed standard grading specifications for yard lumber, are submitted to the lumber industry and the consuming public for their earnest consideration.

In view of the fact that the percentage of hardwoods entering into yard stock is small, probably not over 5 per cent of the hardwood cut, these specifications were prepared primarily to cover softwood yard lumber. Field studies to determine the practical application of the specifications to hardwoods have not yet been made, although according to available information it is believed that the basic and standard grades as stated herein are applicable to such hardwood lumber as is cut into the same products and for the same uses as softwood yard lumber.

PART 1. DEVELOPMENT OF SPECIFICATIONS FOR YARD LUMBER.

HISTORY OF GRADING RULES.

In 1764 Swan Alversdon published in Stockholm, Sweden, the first set of grading rules of which there is any authentic record. These rules recognized four grades of lumber, as follows:

1. "Bests," or clear lumber.
2. "Good," or select lumber.
3. "Common," or lumber containing numerous sound knots.
4. "Culls," or usable lumber containing coarse defects.

"Bests" was a grade which would compare with the basic grades of B and Better as recommended in the report; "Good," a grade which would compare with a combination of C and D basic grades; "Common," a grade which would compare with No. 1 Common; and "Cull," a grade which would correspond to No. 3 Common of the proposed basic rules. These early Swedish grades were based upon the appearance of each piece, and lines of demarcation between grades were drawn on the basis of character and position of defects admissible. The rules were applied to all lumber regardless of the purpose for which the lumber was to be used.

Grading rules were found in use in the New England States in the early part of the nineteenth century. As early as 1833 the State of Maine passed a law which recognized four official grades for pine lumber and authorized the appointment of a surveyor to enforce the grades. These four grades were practically identical with the first Swedish grades. As lumbermen migrated westward into the Lake States the rules went with them, and in the seventies were in use in Michigan. They had, however, been expanded into six grades for use in grading white pine. Grading of lumber under these rules was known to the trade at that time as "Saginaw" inspection.

At about the same time in the late eighties lumber manufacturers' associations were organized in three separate regions of the United States—in the Lake States, along the Atlantic seaboard, and in the Southern States. The principal motive that brought manufacturers together was the formulation of grading rules for the separation of their lumber products into grades of nearly equal quality. In each of these regions the grades first to appear were similar to the grades described above. Names were different and the number of grades larger, but the same general classifications were apparent even though subdivided into two or three grades.

In the Lake States the grades were increased to 12, consisting of 3 grades of clear, 4 of selects, and 5 of common. In the Southern States only 7 grades were recognized, while in the North Carolina pine territory only 4 grades were established. In the Georgia-Florida territory grades were developed which were concerned primarily with the heart content of each piece. For the grading of yard lumber, the grades of the Southern Pine Association have since been adopted. In the first two cases the number of grades was

increased merely by subdividing the 4 grades already described, while in North Carolina pine the 4 grades were practically the same as the grades published by Alversdon. The original 4 have been increased to 6 in recent years.

Since about 1890 all of the large lumber manufacturers' associations have come into existence, and in practically every case the original reason for their formation was the establishment of grading rules.

The Western Pine Manufacturers' Association was organized in 1903. It adapted the rules of the Northern Pine Manufacturers' Association to the species of pine found within its territory. Very minor changes were made in the rules, but the four highest grades were dropped and the fifth grade of the old association was adopted as the highest of the new. However, existence of higher grades was recognized, as is evidenced by the name of the best grade, B Select and Better.

The California White and Sugar Pine Manufacturers' Association had its origin in the California Sugar and White Pine Agency. This company originally used grades which applied only in the vicinity of the mills; but when it became necessary to market its lumber over a wider territory, grading rules were adopted which conformed very closely with grades of the Northern Pine Manufacturers' Association. The highest grade of lumber it sold was of practically the same quality as the B Select and Better of the Western Pine Manufacturers' Association, but the nomenclature of the highest grades recognized by the old manufacturers of white pine in the Lake States was retained and the highest grades were called Nos. 1 and 2 Clear.

In the Pacific Northwest three different systems of grading were developed—one to cover coastwise shipments, one for foreign cargo shipments, and one for the interior rail trade. All three were united in 1903 by the association, which has since become known as the West Coast Lumbermen's Association. The upper grades of lumber were called Clears. This designation has been retained, but the actual quality of the lumber shows a marked parallelism with the upper grades of white pine and more particularly of yellow pine.

The California Redwood Association was organized as early as 1880 as a sales agency, but not until 1900 were any grading rules published. At that time they were very brief, containing only three distinct grades, although a fourth was formed on the basis of sapwood. These grades have since been expanded into six grades. With distinctions on sapwood eliminated, it is found that they correspond very closely with Alversdon's grades.

The grades of the Southern Cypress Manufacturers' Association were originally cutting grades, very similar to the hardwood grades. More recently there has been a gradual tendency toward grades of the yard-stock type. At present the bulk of all cypress lumber sold is graded according to yard-stock or shop rules. The yard rules correspond very closely to grades of pine lumber.

The rules of the Northern Hemlock and Hardwood Manufacturers' Association on softwood were originated as early as 1899. They included grades covering common lumber principally, but since that time grades covering finishing or clear lumber have been added, and the common grades have been expanded from three to five.

These associations believed that the species which they were cutting were different from all others, and that their grading rules must be different. Different systems of grade description and nomenclature were therefore devised, but in spite of the changes thought necessary an analysis of the rules shows they are not greatly dissimilar. Lines of demarcation between grades vary a little among the different associations, and grade description may be vastly different; but the net result of the application of these grading rules is a marked likeness in the quality of the lumber, especially when the grading rules are closely followed.

INDUSTRIES' ACTIVITIES ON LUMBER STANDARDIZATION.

What might be termed the present lumber standardization movement within the lumber industry itself had its official beginning at the first American Lumber Congress held in Chicago, April 14 to 17, 1919. At that time a resolution was passed favoring unification of sizes of all softwood lumber and molding manufactured in the United States. The resolution also issued instruction for the prosecution of the work.

In compliance with this resolution, representatives of the lumber producing, distributing, and consuming industries met in Chicago on June 30, 1919. At this conference further thought was given to the subject of standard sizes, grades, forms, and nomenclature for softwood lumber, moldings, and shingles, and a plan for future work was outlined. A second conference on standardization was held in Chicago on September 28 and 29, 1920, and some very definite steps toward lumber standardization were taken. At various other conferences and meetings of the American Lumber Congress, the National Lumber Manufacturers' Association, and others since that date, the subject of standardization of softwood lumber has been given much attention.

Early in 1922 the Department of Commerce, in connection with its activities on standardization and simplification in industry, became interested in the lumber standardization movement. This resulted in a conference under the auspices of the National Lumber Manufacturers' Association with the Department of Commerce, beginning May 22, 1922, for the purpose of furthering the simplification of lumber grades and nomenclature. Conferences with lumber wholesalers, retailers, and consumers were held separately and jointly with the lumber manufacturers.

Pursuant to resolutions passed at these conferences a general standardization meeting of representatives of all interested industries was held in Chicago on July 21 and 22, 1922. The most important step taken at this meeting was the creation of a committee to continue the work of lumber standardization, which was known as the Central Committee on Lumber Standards. Upon this committee were placed representatives of the lumber manufacturers', wholesalers', and retailers' associations, the railway associations, the American Institute of Architects, and the Association of Wood Using Industries.

This Central Committee created the Consulting Committee whose duties were to handle the technical phases of lumber standardization and to report periodically its findings to the Central Committee

for consideration, approval, and presentation to the entire lumber producing, distributing, and consuming industries.

Several important meetings of the Central Committee on Lumber Standards and conferences of the subordinate Consulting Committee have been held wherein the subject of standardization of sizes, grades, and nomenclature of softwood lumber have been gone into very deeply and much progress made toward the final objectives of the work. Both these committees are still functioning and are bringing much credit to the industry itself.

FOREST SERVICE ACTIVITIES ON LUMBER STANDARDIZATION.

The Forest Service of the Department of Agriculture has for many years been interested in the standardization of lumber products and has spent considerable time upon investigations, results of which would assist in the solution of this problem. With the renewed interest manifested by the lumber producing and consuming industries in the subject of standardization of their raw material, the Forest Service, through the Forest Products Laboratory, increased materially the time and study given this phase of its research activities.

Because of the greater emphasis placed upon standardization of softwood lumber products in its earlier work, the Forest Products Laboratory was able to propose in July, 1922, to a general conference of lumber interests, basic rules for the grading of softwood yard lumber and structural timbers. These later were placed before the industry by the newly created Central Committee on Lumber Standards.

The Forest Service also continued its work to develop for softwoods, standard sizes of yard lumber, universal names for the different woods, and individual grades for products such as flooring, ceiling, and partition. Throughout this work, it has sought and received the advice of the Central Committee on Lumber Standards and its Consulting Committee, and in turn has cooperated with those committees in their work.

Early in its study of the grades of lumber the Forest Products Laboratory found there existed, as has been stated, a great similarity between various commercial rules in use. This indicated that underlying present rules was an expression of the collective judgment of manufacturers, distributors, and consumers of lumber. Once this fact was recognized, the problem of producing standard grading rules became not one of formulating specifications altogether new, but rather a work of harmonizing existing grading rules into a grading specification which should be absolutely definite and impossible of misinterpretation, yet sufficiently elastic to permit the use of judgment on the part of the grader in applying the rules.

FIELD STUDIES AT SEVENTY-FIVE SAWMILLS.

In order to draw up a set of standard specifications that would be practical, it was necessary not only to study the grading of lumber from published rules and in the light of technical information available, but also to study the interpretation and application of the rules at the sawmills. It was known that while many of the published grading rules were extremely vague and general in their wording, there existed

in the minds of the graders themselves interpretations which were very specific as to the defects permissible in different grades. It was also realized that conditions of manufacture, commercial practices and customs adhered to in the different producing and consuming regions, and economic considerations, such as transportation rates, area of distribution, and supply and demand for each particular species and product manufactured, influenced the grades, sizes, and nomenclature used and the shipping practices followed.

In order to collect authentic information on these phases, studies were made by the Forest Products Laboratory at 75 sawmills distributed throughout the softwood regions of the Lake States, Inland Empire, Pacific Northwest, California, central and southern Rocky Mountains, Arkansas, Gulf States, and Carolinas, and the region extending from the Tonawandas eastward through the Adirondack Mountains and the New England States.

Information was obtained on amounts and percentages of species; products and grades produced; rough and finished sizes; existing shipping practices; regions of distribution; types, prevalence, nature, and seriousness of defects; local interpretations of grading rules; methods of manufacture; and methods of seasoning.

During these studies at typical mills measurements were made on approximately 750,000 feet of lumber to determine variations in sawing, amount of shrinkage in seasoning, and the minimum amount of wood required for proper dressing of the lumber. In addition, 500,000 feet of lumber was inspected to determine the method of applying grading rules of the associations and the comparison between local inspection rules and the basic grading rules contained herein.

FIELD STUDIES TO DETERMINE THE REQUIREMENTS OF CONSUMERS.

Besides the sawmills visited, large numbers of representative wholesalers, retailers, engineers, architects, railroad officials, and consumers in different parts of the United States were consulted; association conventions and lumber standardization conferences were attended, and the individual and collective views of those present obtained.

Studies have been made from time to time of the use of wood in house construction and in the various wood-using industries, such as the box, sash and door, furniture, wood-turning, vehicle, agricultural implement, airplane, shipbuilding, and other industries. The retail and wholesale distribution of lumber have also been studied at length. The results of these studies have been taken into consideration and the opinions of those who conducted them obtained as to the influence of the present sizes and grades of lumber upon these industries and upon the distribution of lumber.

FOUR PRINCIPAL SYSTEMS OF GRADING.

While all lumber was originally graded on one basis, developments in the lumber industry and differences in the requirements of wood consumers have led to the development of four distinct systems of grading, each on a different basis for each general class of uses; i. e., (1) structural timbers, (2) softwood factory lumber, (3) hardwood factory lumber, and (4) yard lumber.

STRUCTURAL TIMBERS.

Lumber for structural purposes must be graded primarily on the basis of strength. Durability and uniformity of manufacture are also commonly taken into consideration in commercial rules. The first rules which considered structural lumber from this standpoint were the legal rules for the State of Maine. These rules considered little else than uniformity of size, and since most of the timbers were hewn large variations were permitted. The next concerted attempt to establish rules for structural timbers was made by the lumber exchanges of large Atlantic coast cities in conjunction with the Georgia Interstate Sawmill Association. The rules developed were and still are known as the Interstate Rules of 1905. They considered timber from the standpoint of durability, uniformity, and quality, as evidenced by wane, shakes, and knots. Several years ago the density rule, which supplies a means of determining visually the relative strength of different specimens of southern yellow pine and Douglas fir, was developed by the Forest Service and has been used to some extent for the grading of these species. The density rule also supplements structural timber grades developed by the Forest Products Laboratory.

The basic grading rules proposed for structural timbers have been published as Department Circular 295 of the United States Department of Agriculture.

SOFTWOOD FACTORY LUMBER.

Softwood factory lumber is the material used for the manufacture of sash and doors and general millwork. The system of grading known as rules for grading shop or factory lumber was originated to cover lumber for this use and has been employed for a number of years. The grades are fairly uniform in the different associations. They are based upon percentage of cuttings of certain sizes and qualities obtainable from each piece. As some of the sizes are no longer required, it is probable that these grades might be improved by bringing the size requirements up to date. A study is being made of these grades in cooperation with the various softwood lumber manufacturers' associations and the sash, door, and millwork associations and the results will appear in a separate publication.

HARDWOOD FACTORY LUMBER.

Hardwood lumber is usually required in the manufacture of such products as furniture, show cases, musical instruments, implements, vehicles, and certain classes of other products. Manufacturers of these articles buy hardwoods according to grades in which the determining factor is number and character of defects, as in the combined grade of Firsts and Seconds, or percentage of clear or sound cuttings that can be obtained from each piece in other grades. These manufacturers have always preferred to buy their lumber in the rough. For this reason, the manufacture of hardwood at the sawmill has not in the past ordinarily progressed beyond the point of air seasoning in the form of long, wide lumber.

Despite this practice, there exist large opportunities for the profitable manufacture at the sawmill of small dimension stock, ready cut to the rough sizes and shapes required by the secondary wood-using industries, either from slabs, edgings, and low-grade lumber or direct from the log. In addition, there exists an increasing

demand among the secondary wood-using industries for hardwood material of this character.

The Forest Service has realized for many years that the more extensive production and use of small dimension stock will benefit the lumber producer and wood consumer, as well as conserve forest material. For these reasons, the Forest Products Laboratory undertook, about two years ago, an intensive study of the small dimension stock problem. The first consuming groups selected for study were the chair and wood-turning industries.

This work has now been expanded to include a study of the grading of hardwood lumber. This problem is being approached from both the manufacturing and consuming ends. A survey of the principal hardwood-producing regions is being made to determine the influence of conditions of manufacture and distribution upon hardwood grades. At the same time the principal hardwood-consuming industries are being studied to determine the applicability of existing grades to the needs of the consumers.

This work by the Forest Products Laboratory has received the full indorsement of the lumber-producing and wood-consuming industries and in its conduct the support and cooperative assistance have been and are being received from the following organizations: Central Committee on Lumber Standards; National Hardwood Lumber Association, Hardwood Manufacturers' Institute, Association of Wood-Using Industries, National Association of Chair Manufacturers, National Association of Wood Turners, National Alliance of Furniture Manufacturers, Southern Furniture Manufacturers' Association, National Association of Table Manufacturers, Associated Office Furniture Manufacturers, National Commercial Fixture Manufacturers' Association, Society of Automotive Engineers, and Railway Car Manufacturers' Association. In addition, this work has been approved by a large number of individual manufacturers and firms among the lumber-producing and wood-consuming industries who are not affiliated with any organized trade associations.

YARD LUMBER.

Yard lumber constitutes the largest division of all. It is not based actually on any one particular use. The practice of carrying this material in stock both at the sawmill and in distribution yards, however, has given to it the name of yard stock. Yard stock, generally speaking, is all lumber which is manufactured and classified into various sizes, shapes, and qualities required for ordinary domestic and industrial purposes. It does not include the classes named above, with the exception of a small amount of hardwood yard stock which may possibly be graded under these rules, nor a few special-use classes. It is for this class of stock that standard grading rules are here proposed.

BASIS FOR GRADE STANDARDS.

BASIC AND STANDARD GRADES DEFINED.

In the preparation of grading rules for yard lumber, the Forest Products Laboratory has pursued the following method: First, a set of rules for segregating lumber into classes in which all pieces would have nearly equal quality was formulated. Quality alone

was considered, and no attention was paid to the many refinements required by particular uses or to the regulations and rules regarding sizes, shipping instructions, grain of the wood, etc. Next, complete grading specifications were prepared for each of the principal forms of yard lumber. These specifications contained all the provisions necessary for the grading and shipping of lumber. They used the first set of rules as the basis for determining quality only. For this reason the first set of rules is called "basic grading rules." The second or complete set of rules is called "standard grading rules."

The basic grading rules harmonized into grades of equal quality lumber manufactured in the various regions from the same or different species of wood used for the same general purposes. They aim to segregate yard lumber into quality classes which will have the widest applicability to the needs of the largest number of consumers. Basic grades for yard lumber can not be prepared to apply to all specific uses. They are designed to separate the product of a typical log into grades according to the broad principles of appearance and the suitability for use of each piece as a whole. They may be applied with slight change in the grading of finishing and common boards, dressed two sides, but require some modification in order to be applied in the grading of other forms of yard lumber such as flooring or dimension.

Standard grades for yard lumber are those which adapt the basic grades to the various forms of yard lumber by such modifications as are required by the use to which the lumber is to be put, or as may, in the interest of conservation and economy, be permitted without interfering with its use. Standard grades for each specific product are commonly fewer in number than the basic grades. The reason for this is that quality requirements of specific uses are usually defined by closer limits than the total range of quality of lumber produced by the tree.

The manner in which this is done may be illustrated by the grades of siding. Since this material is painted and exposed to the heat of the sun, restrictions must be made on the amount of pitch admitted in the grades. At the same time defects may be admitted on the thin or covered edge of siding which would not be admitted in the corresponding basic grades.

The standard grading rules which are formulated from the basic grades take into account all defects commonly found in lumber and are designed to apply to all species. They are designed for species of lumber having qualities which make profitable their segregation into all the basic grades and which permit their manufacture into all the forms of yard lumber specified, but can be adapted to any of the commercial species from which yard lumber is produced.

In order to be effective media on which lumber may be bought and sold, grading rules must go further than separating lumber according to a quality basis alone. They must also prescribe rough and dressed sizes for each product, provide a standard nomenclature, indicate the percentages of short lengths in shipments, provide rules for determining the grain, and sapwood content, and give instructions for interpreting the grade definitions and for making shipments under them. Generally speaking, "grade" as used here refers to the quality of lumber, while "specification" is a larger term and includes the grade or quality definitions as well as the other essentials

named above. The "grading of lumber" is the process of segregating lumber for shipment according to definite specifications. In this publication, it has been the aim to provide complete specifications for the grading of lumber.

In adapting these standard specifications to species which do not warrant segregation into so many grades, various standard grades may be combined and the lower grade considered as the limiting factor. It will be understood, however, that the quality of the grade will range from the lower grade to the next higher standard grade specified. Furthermore, grades for only such products as are commonly manufactured need be taken. Any adaptations of these rules which are required by the peculiarities of the species in question can be made, provided that such changes do not raise or lower the general quality of the grade as determined by the defects or blemishes present. In this way associations cutting a species in which the sapwood is of such a distinctly different color or character as to be objectionable may provide for all heartwood grades, merely stating that sapwood will not be permitted or will be restricted to a certain amount in any grade. If, in formulating grades for a particular species, it is found that defects or blemishes are admitted in the standard grades which are not found in the species under consideration, it is, of course, not necessary that these defects be mentioned as admissible in any grade.

SIMILARITY IN TREE GROWTH.

Although it is true that no two boards are exactly alike, a consideration of the broader aspects of tree growth indicates that there are more similarities than dissimilarities between trees, making it possible to draw fairly accurate comparisons of quality between lumber produced from different trees and different species.

All trees have branches which occur either singly, opposite each other, or in whorls. Most of these branches start at the pith and grow in length and diameter every year. The result is a cone-shaped branch end intergrown with the surrounding wood and with the apex at the pith. Some branches do not originate at the pith, but sprout from the side of the trunk. Such branches, however, are rare in forest-grown material.

Sections of branch ends, made when the saw cuts through the branch ends in the process of lumber manufacture, are known as knots. The shape of each knot is determined largely by the angle at which the saw cuts through the branch end. In the forest many of the lower branches of trees, lacking the necessary light, die and fall off. This is known as natural pruning. The better the conditions for natural pruning, the closer to the pith of the tree will branches be broken off. As the tree continues in its diameter growth, the stubs of branches become surrounded by additional wood. This new growth, however, is not connected by fibers to the stubs; hence, when these stubs are sawed through, encased knots result. Wood added beyond the stub ends of the branches commonly produces that part of the log from which the clear lumber is manufactured. Lumber cut from the top logs, which have not been naturally pruned, contains coarse knots. In trees growing in the open the lower branches are not shaded, and hence they persist nearly to the base of the trees.

Practically all wood is subject to the action of rot-producing fungi of one species or another. Many of these fungi work on the heartwood of living trees, gaining entrance through broken branches, fire scars, insect holes, bird pecks, or similar openings in the tree. This is the reason why decay is most often found in lumber produced from near the center of the log. Besides heart-rotting fungi there are fungi which attack the sapwood of the living tree wherever it may become injured. Both heartwood and sapwood of sawed lumber are subject to the action of wood-destroying fungi, if conditions of moisture, air, and temperature are favorable.

Although all trees do not have pitch streaks and pitch pockets, the majority of the softwood species are subject to these blemishes and defects. The amount of pitch found in a given species varies so much that it is difficult in many cases to state that one wood is any freer than another from this defect. A typical pitch pocket in southern yellow pine may be shorter and wider than one in Douglas fir, but if the pitch pockets are equal in area they are practically equivalent in damaging effect.

Most woods are subject to the attack of insects or to the grubs or worms which are one stage in the life of an insect. The holes vary in the size from minute pinholes to channels one-half inch in diameter. Other types of holes are produced by loose knots falling out, and by rafting pins, tools, and the like. Their effect on the use of lumber depends upon the number and size of the holes rather than upon the agent which produced it.

During seasoning, the difference between radial and tangential shrinkage and the too rapid drying out of the surface are likely to produce in any wood certain defects, such as checks, cracks, case-hardening, checking of knots, loosening of encased knots, and honeycombing. Furthermore, unless the wood is properly weighted down during seasoning, this difference in shrinkage produces cup, bow, crook, and twist. Not only are these latter defects serious in themselves, but they are apt to cause further defects, such as skips and splits, when the lumber is dressed.

All woods have a pith which may appear as a defect on a piece of lumber if the saw or planer knife passes through it. All woods have bark which may produce waney-edged lumber. All are subject to imperfect manufacture, various degrees of cross grain, shake, and stains.

Since all species of trees grow in the same general manner and are subject to the attack of the same destructive agencies, lumber sawed from them must be similar from the standpoint of the defects and blemishes present. Certain defects and blemishes may be more prominent in one species or tree than in another, but their effect upon the use of the lumber will be equivalent. From the standpoint of tree growth, therefore, it is entirely feasible to formulate universal rules for the grading of lumber.

SIMILARITY IN REQUIREMENTS OF USE.

An analysis of the uses to which yard lumber is commonly put brings out certain classes of material for which a certain range in quality is suited. The principal forms of yard lumber are as follows:

Finishing, rough or dressed; Casing and Base; Moldings.
Common Boards (and Strips), rough or dressed; Ship-lap; Dressed and Matched.
Dimension.
Flooring.
Ceiling and Partition.
Siding; Drop Siding; Rustic Siding; Bevel (Plain, and Bungalow or Colonial) Siding.
Factory Flooring, Heavy Roofing, Decking, and Sheet Piling.

Each class of products enumerated above brings to mind certain requirements as to size and to grade. Economic conditions and competition have resulted in many minor variations in the specifications for these products. An analysis of the principal requirements of their uses, however, indicates that there exists economical and logical sizes for each class and that there are certain types of defects and blemishes which are practically equivalent, in so far as their effect upon use is concerned. In view of the similarity in use within each of these classes of lumber, uniform sizes and grades can be prescribed for each.

SIMILARITY IN EXISTING LUMBER GRADES.

A study of existing grading rules further demonstrates the possibility of standard grading specifications. All associations have a best grade which is practically free from defects, irrespective of what the grade may be called. Again, all associations have a poorest grade which consists of the lowest quality lumber that can be economically disposed of; that is, a grade which is suitable for only the cheapest kind of work.

Between the highest and lowest grades there is a type of lumber which contains sound knots, usually of limited size, and which may be considered more or less water-tight. This may be considered the intermediate grade.

The manner in which the grading rules of the principal associations of softwood lumber manufacturers compare with the basic grading rules for yard lumber recommended by the Forest Service is shown in Chart 1. The nine proposed basic grades are found in the left-hand column, together with brief general descriptions of these grades. In succeeding columns the grades of finishing lumber and common boards of the principal softwood associations are shown in their relative position with respect to the basic grades.

This comparison is made primarily on the basis of the defects shown in the published official grading rules of the associations as admissible in the various grades. Inasmuch as it is impracticable to show graphically deviations from the published rules which may exist to greater or less degree in actual grading practices this chart should be considered as an indicative rather than an absolute comparison.

In the course of the field studies made by the Forest Products Laboratory, panels of board of each of the important commercial species, graded according to local association grades and typifying the highest, average, and lowest quality of material permissible in each grade, were selected and photographed. These photographs were then arranged in a scale representing quality from the best to the poorest grade. A typical quality scale is shown, in two sections, in Plates I and II. It illustrates the complete range in quality with reference to the types and degrees of seriousness of defects and blemishes which are to be found in the different woods.

A close analysis of Plates I and II indicates that grades can be defined to such an extent that it will be possible to separate lumber into classes of similar quality, irrespective of the wood to which they are applied. It is not to be expected, however, that all woods will produce all of the grades in sufficient quantities to make it economical to sort them out.

The principal differences between the existing lumber specifications are due to the fact that some associations have made more divisions than others between the best and intermediate type or between the intermediate and the poorest type. This situation has been somewhat complicated by different grade nomenclature being applied to the same qualities of lumber or by the fact that the same grade name as used by another association was applied to a little higher or lower quality. Furthermore, in many cases, there has been a great deal of emphasis placed on the fact that the defects in one wood were different from those in another wood. This is not due in many cases to the presence or absence of the different kinds of defects and blemishes to which a wood is subject, but rather to the fact that the same kind of defect or blemish may be a little more prominent in one wood than in another.

BASIS FOR STANDARD SIZES.

BOARD-FOOT STANDARD.

In the early days of lumber manufacture practically all lumber cut into boards or planks was sold on surface measure. A surface area of 1 square foot was considered 1 board foot, regardless of the thickness. Timbers, however, were sold on cubic measure. A need then arose to measure logs in terms of lumber measure. Thus it was necessary to adopt a standard thickness for the board foot, and gradually it became the practice to consider 1 inch as that standard for thickness. Lumber thicker than 1 inch was measured as the product of its surface area in square feet by the thickness in inches, while lumber thinner than 1 inch remained on surface measure. This board-foot unit was applied to lumber in the rough. Dressed lumber was always considered as of the same footage as the rough lumber used in its production.

To-day very little yard lumber is sold in the rough, although the rough unit of measurement is used as the basis of computation and the rough or nominal size is used to designate individual items of lumber. Board-foot measurement is actual measurement when applied to rough green lumber only. In the same way, nominal sizes are actual only when applied to rough green lumber.

The board-foot standard is the most advantageous unit of measurement yet devised for use in computing lumber production and costs from the stump to its final use, in comparing prices of various products, and in compiling statistics of the lumber industry. Nevertheless, the purchaser of dressed lumber must keep in mind that sizes and measurements are purely nominal.

DEVELOPMENT OF PRESENT-DAY SIZES.

Lumber was originally sold in the rough, and where a smooth surface was required it was necessary to plane material by hand. If boards 1 inch thick were used they were laboriously planed down by hand to about $\frac{15}{16}$ inch.

CHART 1.- COMPARIS CIPAL MANUFACTURERS' ASSOCIATIONS

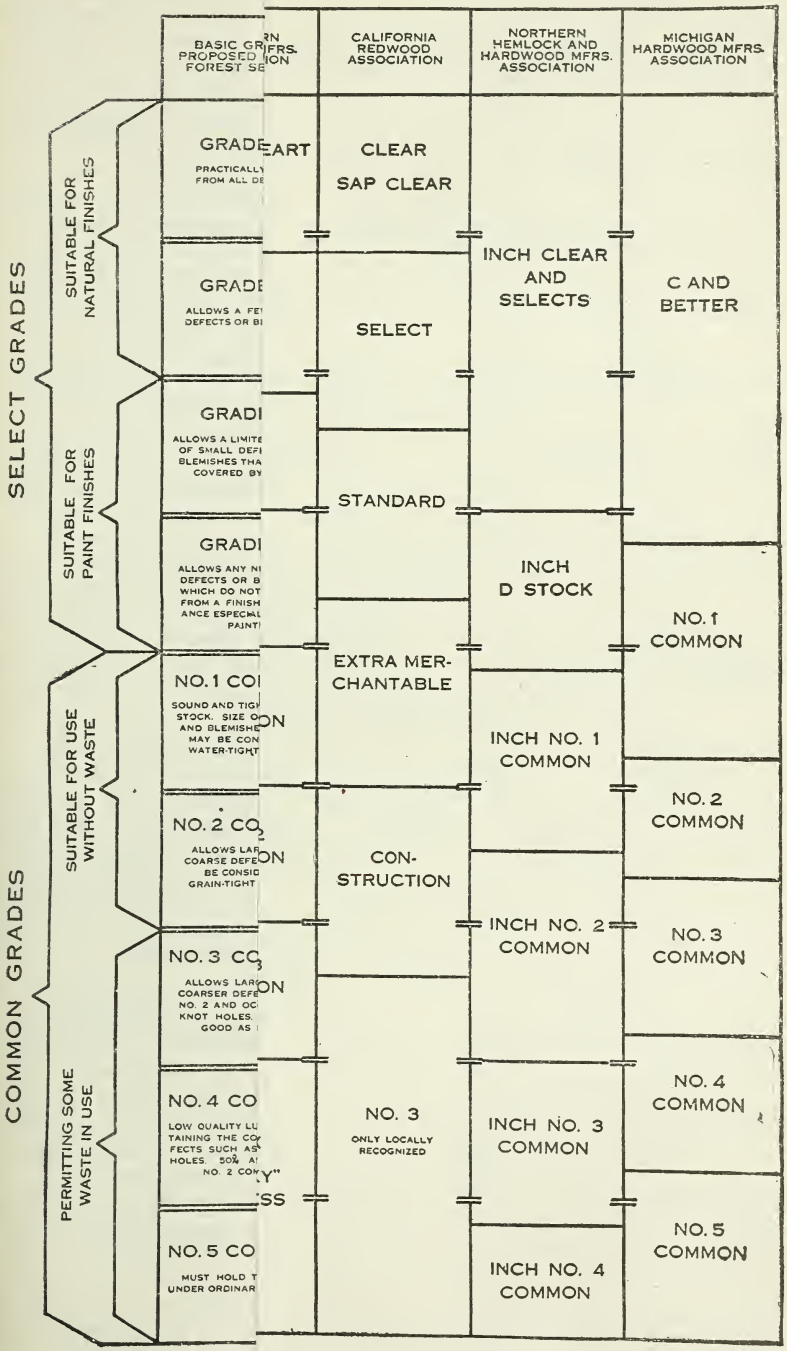


CHART 1.- COMPARISON OF FOREST SERVICE BASIC GRADES FOR SOFTWOOD YARD LUMBER AND GRADES OF THE PRINCIPAL MANUFACTURERS' ASSOCIATIONS

BASED ON DEFECTS PERMITTED IN EACH GRADE AS SHOWN IN PUBLISHED GRADING RULES

	BASIC GRADES PROPOSED BY THE FOREST SERVICE	NORTHERN PINE MANUFACTURERS' ASSOCIATION	WESTERN PINE MANUFACTURERS ASSOCIATION	CALIFORNIA WHITE & SUGAR PINE MFRS. ASSOCIATION	WEST COAST LUMBERMENS' ASSOCIATION	SOUTHERN PINE ASSOCIATION	GEORGIA-FLORIDA SAWMILL ASSOCIATION	NORTH CAROLINA PINE ASSOCIATION	SOUTHERN CYPRESS MFRS. ASSOCIATION	CALIFORNIA REDWOOD ASSOCIATION	NORTHERN HEMLOCK AND HARDWOOD MFRS. ASSOCIATION	MICHIGAN HARDWOOD MFRS. ASSOCIATION
SELECT GRADES — SUITABLE FOR NATURAL FINISHES	GRADE A PRACTICALLY FREE FROM ALL DEFECTS	1 CLEAR 2 CLEAR 3 CLEAR A SELECT	B SELECT AND BETTER	NO. 1 AND 2 CLEAR	SELECTED FLAT GRAIN	A FINISHING	A FINISHING	NO. 2 AND BETTER	CLEAR HEART A	CLEAR SAP CLEAR	INCH CLEAR AND SELECTS	C AND BETTER
SELECT GRADES — SUITABLE FOR NATURAL FINISHES	GRADE B ALLOWS A FEW SMALL DEFECTS OR BLEMISHES	B SELECT		C SELECT	NO. 2 CLEAR	B FINISHING	B FINISHING		B	SELECT		
SELECT GRADES — SUITABLE FOR PAINT FINISHES	GRADE C ALLOWS A LIMITED NUMBER OF SMALL DEFECTS AND BLEMISHES THAT CAN BE COVERED BY PAINT	C SELECT	C SELECT		NO. 3 CLEAR	SELECT COMMON FINISHING	C FINISHING	NO. 3	C	STANDARD		NO. 1 COMMON
SELECT GRADES — SUITABLE FOR PAINT FINISHES	GRADE D ALLOWS ANY NUMBER OF DEFECTS OR BLEMISHES WHICH DO NOT DETRACT FROM A FINISH APPEARANCE ESPECIALLY WHEN PAINTED	D SELECT D STOCK AND BOX	D SELECT	D SELECT	SELECT COMMON USUALLY WITH NO 1 COMMON	NO. 1 COMMON	NO. 1 COMMON		D	EXTRA MERCHANTABLE	INCH D STOCK	
COMMON GRADES — SUITABLE FOR USE WITHOUT WASTE	NO. 1 COMMON SOUND AND TIGHT KNOTTED STOCK. SIZE OF DEFECTS AND BLEMISHES LIMITED; MAY BE CONSIDERED WATER-TIGHT LUMBER	NO. 1 COMMON	NO. 1 COMMON	NO. 1 COMMON	NO. 1 COMMON			NO. 1 BOX	NO. 1 COMMON		INCH NO. 1 COMMON	NO. 2 COMMON
COMMON GRADES — SUITABLE FOR USE WITHOUT WASTE	NO. 2 COMMON ALLOWS LARGE AND COARSE DEFECTS. MAY BE CONSIDERED GRAIN-TIGHT LUMBER	NO. 2 COMMON	NO. 2 COMMON	NO. 2 COMMON	NO. 2 COMMON	NO. 2 COMMON	NO. 2 COMMON		NO. 2 COMMON	CONSTRUCTION	INCH NO. 2 COMMON	NO. 3 COMMON
COMMON GRADES — PERMITTING SOME WASTE IN USE	NO. 3 COMMON ALLOWS LARGER AND COARSER DEFECTS THAN NO. 2 AND OCCASIONAL KNOT HOLES. 75% AS GOOD AS NO. 2	NO. 3 COMMON	NO. 3 COMMON	NO. 3 COMMON	NO. 3 COMMON	NO. 3 COMMON	NO. 3 COMMON	NO. 2 BOX	NO. 3 COMMON			
COMMON GRADES — PERMITTING SOME WASTE IN USE	NO. 4 COMMON LOW QUALITY LUMBER CONTAINING THE COARSEST DEFECTS SUCH AS ROT AND HOLES. 50% AS GOOD AS NO. 2 COMMON	NO. 4 COMMON	NO. 4 COMMON	NO. 4 COMMON				RED HEART BARK STRIPS	BOX "PECKY" CYPRESS	NO. 3 ONLY LOCALLY RECOGNIZED	INCH NO. 3 COMMON	NO. 4 COMMON
COMMON GRADES — PERMITTING SOME WASTE IN USE	NO. 5 COMMON MUST HOLD TOGETHER UNDER ORDINARY HANDLING	NO. 5 COMMON	NO. 5 COMMON	NO. 5 COMMON	CULLS ONLY LOCALLY RECOGNIZED	NO. 4 COMMON	NO. 4 COMMON				INCH NO. 4 COMMON	NO. 5 COMMON

Coincident with the development of new and labor-saving machinery planing mills were built for use in dressing lumber. The lumber used was cut in the vicinity and transported to the planing mill by wagons or water at small cost. It was cut in excess of nominal size, at least in thickness, but in order to obtain smoothly dressed boards of uniform size it was found necessary to surface them to $\frac{7}{8}$ inch in thickness by from $\frac{1}{8}$ to $\frac{1}{2}$ inch scant in width.

With the cutting-out of timber stands adjacent to large consuming centers, the migration of lumber manufacturers to large timber stands in distant forest regions, and the development of railroads, it became apparent that to ship lumber in the rough to be planed down later involved an unnecessary economic waste. Within recent years high-powered, high-speed machines have been developed. These machines plane lumber more cheaply than those which preceded them but commonly require a slightly deeper cut. Thus it has gradually become the practice to produce dressed air-dried lumber $\frac{26}{32}$ inch in thickness in some regions, $\frac{25}{32}$ inch in others, and $\frac{24}{32}$ inch in still others. However, among lumber-manufacturing associations in those regions producing over 60 per cent of the total lumber cut of the United States, $\frac{26}{32}$ inch is the prevailing official thickness for finishing and common boards of so-called "inch size," dressed two sides.

There has been a similar gradual change in the dressed thickness of "2-inch" dimension, until to-day it varies from $1\frac{1}{2}$ to $1\frac{3}{4}$ inches, although $1\frac{5}{8}$-inch is the prevailing official thickness for "2-inch" dimension surfaced one side and one edge, in regions producing more than two-thirds of the total softwood lumber cut. In widths variation from $\frac{5}{8}$ to $\frac{1}{4}$ inch scant exist, but here again the custom in the principal lumber-producing regions is uniform; that is, $\frac{3}{8}$ inch scant on widths up to 7 inches and $\frac{1}{2}$ inch scant on wider widths.

While there are other forms of lumber which have a diversity of finished sizes, the most important forms, by reason of amount produced, are so-called "1-inch" finishing and common boards and "2-inch" dimension. Hence, these forms of lumber will be considered first. Once standards are established for the thickness and width of these products other forms will conform as nearly as use and good practice will permit.

BASIC PRINCIPLES INVOLVED IN ESTABLISHING SIZES.

Four important factors which must be recognized as fundamental in establishing proper sizes for yard lumber are economical lumber distribution, forest conservation through elimination of waste, the requirements of use, and present manufacturing practice. The size of each different form of yard lumber should be prescribed only after a careful balancing of the many phases involved in each of these factors. In this way only can correct sizes be determined.

There are several factors connected with economical lumber distribution, among which may be enumerated freight rates, competition between species and with substitutes for wood, sufficient thickness or width to prevent warping while in storage, sufficient size to prevent breakage in handling, and a reduction in the number of sizes so as to economize in storage space and also to make possible an interchange of species by the lumber distributor.

The great timber reserves of the United States are being cut out at a rapid rate. The end of our supply of virgin timber is now in sight, and unless more extensive methods of propagating forests are practiced than are at present common the time is not far distant when the total lumber supply of the United States will be so small as to increase substantially the cost of lumber. For this reason the smallest size that is consistent with good utilization and which can be produced from lumber without waste should be prescribed as a means of conserving our fast diminishing forest resources.

The factors of economical distribution and conservation are important and are given full consideration in arriving at the sizes recommended. The requirements of use and manufacturing practice are of far greater importance, however, and will be discussed in detail.

EFFECT OF REQUIREMENTS OF USE UPON SIZES.

The importance of the requirements of use in the determination of standard sizes must be recognized as the greatest. Sizes which do not meet the needs of consumption will ultimately cease to exist and substitutes will thrive. Generally speaking, the sizes of each form of yard lumber should be the smallest which can be used from a general strength or utility standpoint and yet give a maximum service per unit of cost.

These minimum sizes differ for different uses. When there are a large number of uses, as in the case of finishing and common boards and dimension, the size must be such as will give satisfactory service for the largest number of uses and at the same time fulfill the conditions indicated under the other factors named above.

SCIENTIFIC DATA AVAILABLE.

A great amount of test data obtained by the Forest Service has a significant bearing upon the problem of the most economic thicknesses of common boards and dimension. This information has been collected in connection with many fundamental studies of the mechanical and physical properties of wood, relation of the shrinkage and strength of wood to its specific gravity, effect of moisture upon the strength and stiffness of wood, design of wooden boxes, effect of decay on timbers, amounts of lumber used in the manufacture of wooden products, effect of knots on the strength of lumber, effect of kiln-drying on the strength of wood, warping of ply wood, effect of rate of loading on the strength of wood, value of tongued and grooved joints in lumber, effect of thickness on nail-holding power of wood, and effect of thickness on the amount of work required to drive nails in common boards.

Although the test results referred to have a bearing on the problem in hand, no amount of laboratory testing will ever prove beyond doubt what is the most economical thickness. However, long experience in determining the significance of the data and extensive observation of the behavior of wood in the light of the information available provide a basis upon which accurate conclusions can be reached in most cases.

THICKNESS OF "ONE-INCH" BOARDS.

So-called "inch" lumber is one of the most important sawmill products. It is produced in every quality and is put to a vast number

of uses. Of these, house construction is the largest, followed by box manufacture and car construction. For each of these uses certain properties are required, such as stiffness, resistance to warping, and nail-holding ability.

PROPERTIES REQUIRED.

The first essential property is that of breaking strength. The board must be of sufficient thickness to meet the requirements of loading to which it may be subjected. Strength tests have determined the average strength and the variation to be expected of boards of various species. Engineering literature and practice provide information as to the loading requirements.

In the theoretical consideration of thickness, once a working value for breaking strength has been established, it must be borne in mind that the change in strength in per cent is more than twice the change in thickness in per cent. Thus, a change of $\frac{1}{32}$ inch in the thickness of an ordinary board will change its volume about 4 per cent, whereas its strength is changed about 8 per cent.

Closely allied with the consideration of breaking strength is that of stiffness. Stiffness gives rigidity to the structure in which the lumber is used, it reduces warping, and is a factor in the proper driving of nails. The tests which furnished the data on the breaking strength of the various species also furnished information as to their stiffness. From a theoretical standpoint a change in thickness produces a far greater effect on the stiffness than on the strength. Thus, in the example above quoted, where a $\frac{1}{32}$-inch change in thickness, or a 4 per cent change in volume produces a change of about 8 per cent in strength, the stiffness is changed about 12 per cent.

The next important question is the effect of change in dimension on the mechanical resistance to warping. This resistance is far less in thin boards than in thick ones; consequently, the former have to be fastened at more frequent intervals to keep them in place. The increased tendency to warp may mean the opening of more holes between the thin boards, or the lumber may become unfit for use before it is put into the structure. It should not be supposed that if the thickness of a board is reduced by a certain percentage the resistance to warping is decreased a like amount; using the same example again, with a 4 per cent reduction in thickness of an ordinary board, there may be expected a decrease of warping resistance of at least 8 per cent.

A factor of less importance, perhaps, than those already mentioned but worthy of consideration, is the effect of the thickness of a board on its nail-holding qualities. The resistance to withdrawal of a nail is directly proportional to the depth to which it is driven, provided it does not go through the member. Furthermore, if a nail extends through a board and splinters the back side, it does not hold so well as one that does not reach entirely through. Laboratory tests indicate that within a given species and under given conditions the nail-holding ability of wood varies directly with its thickness.

Another important factor relating to the thickness of common boards is the amount of work required to drive nails through boards. Special tests were conducted whose purpose was to show the difference in amount of work required to drive nails resulting from differences of $\frac{1}{32}$ of an inch in thickness of common boards. The results

obtained indicate that the energy required to drive nails into boards between supports increases as the thickness decreases. This increase in the difficulty of driving nails not only tends to cause dissatisfaction with the material but increases the liability of overdriving nails at supports.

The theory has been advanced that it would be safe to reduce the thickness of matched material without sacrificing strength because of the added stiffness furnished by tongue-and-groove joints. Special tests on boards 8 inches wide lead to the conclusion that every plank of this width in both plain-joint and tongue-and-groove paneling acts practically as a single beam and that no difference exists in the ultimate strength of these types of construction due to the character of the joints. In general, it is concluded that while tongue-and-groove paneling has many advantages, such as tightness, smoothness, and prevention of distortion from warping, it does not increase the ultimate strength of boards of this width, and a decrease in thickness from a strength standpoint is not justifiable. In narrow boards, however, the tongue and groove will doubtless increase the stiffness of individual boards; and in end-matched top floors of species such as oak and maple, even when supported on furring strips, tongue-and-groove boards probably will have sufficient strength to carry the orinary loads which will come upon them, provided the material is $\frac{13}{16}$ inch in thickness.

PROPERTIES INVOLVED IN THE PRINCIPAL USES.

More boards are used for house construction than for any other purpose. They are used for sheathing, roofing, subflooring, and shelving. They must be of sufficient thickness to carry any of the concentrated loads to which they are usually subjected, and to give rigidity to the structure. The lack of sufficient rigidity is reflected in the cracking of plaster, the jarring often noticed in dwellings, and the rapid disintegration due to weaving.

Insufficient thickness may cause warping in boards, making them unfit for use or increasing the difficulties of construction.

Large quantities of boards are used for concrete-form material, for which use they must often carry considerable loads and be sufficiently stiff to resist warping under conditions particularly favorable to it.

The question of the relation of thickness and nail-holding qualities in house construction is chiefly confined to roofing and subflooring. In general, the thicker the board the greater its nail-holding power. Also, the thinner the material the greater the likelihood of the nail extending clear through.

Inch lumber in select quality is used for interior trim and finish. Casing, base, moldings, and built-in cabinetwork are examples of this use. These products are commonly remanufactured from ordinary finishing lumber at sash, door, and millwork factories and planing mills. This remanufacture requires that lumber be of maximum thickness when received in order to permit of further working and still have the necessary strength and thickness.

The box industry consumes more than 4,000,000,000 board feet of lumber annually. Approximately 70 per cent of this material is inch lumber. This represents 15 to 20 per cent of the total production of 1-inch stock. The large majority of the boxes manu-

factured are designed to carry loads of from 50 to 100 pounds. The material used in this construction is chiefly resawed from inch lumber. The standard railroad container specification requires the thickness of material for such boxes to be $\frac{3}{8}$ inch for sides, tops, and bottoms; and exhaustive tests have indicated that with present grades the so-called $\frac{3}{8}$-inch lumber which is obtained by careful manufacture from the $\frac{13}{16}$-inch stock is the smallest that can be used for satisfactory service. Practice has also shown that thinner material for such boxes will not give satisfactory results.

The third largest use of lumber in the United States is for car construction. Boards are used chiefly in box cars for siding, lining, roofing, and running boards. In box cars, practically anything from $\frac{3}{4}$ to 1 inch could be used and would probably give a fair degree of satisfaction. The racking which cars receive, the exposure to conditions conducive to warping, and the necessity for nails holding demand the maximum thickness compatible with economical manufacture. The thicker the material the better service it will give.

There are numerous other uses for inch lumber, such as in vehicles, furniture, tanks, fixtures, caskets, gates, ladders, and signs. All of these require maximum stiffness of material or sufficient thickness to permit of remanufacture.

THE MOST SUITABLE THICKNESS FOR COMMON BOARDS.

The most economical thickness from the standpoint of service is a variable depending upon several factors whose influence may be immediate and tangible or remote and intangible. Among these may be enumerated the prevailing methods of construction, the varying ratio of the amounts being consumed in the different uses, and numerous economic conditions. The savings in manufacturing and freight of thinner material are immediate and tangible while the elements which enter into service make the results remote and intangible. While in considering the proper thickness of material the importance of the direct and immediate savings are evident to all, yet the intangible or service conditions can not be overlooked. If an attempt is made to establish a standard much below the thickness which under present conditions will give a maximum of service per unit of cost, the demands of the trade will result in a variety of thicknesses and the so-called standard will become a dead letter.

It is practically impossible to correlate all the factors affecting service, and no amount of testing will ever give definite proof as to the most suitable thickness. It would be extremely difficult to simulate conditions of long-time service and without such information the reduction to service conditions of data from the usual tests can not be definite. Therefore the various factors must be weighted largely through judgment and experience.

With the cost of manufacturing 1-inch material as a basis, it is possible to compute a theoretical cost per unit of surface of boards varying in thickness from $\frac{1}{2}$ inch to $1\frac{3}{4}$ inches. For thicknesses less than 1 inch this cost is slightly greater than the direct proportion between these thicknesses and that of 1 inch, while for thicknesses greater than 1 inch the cost is proportionately less.

It is also possible to estimate for the different uses the comparative service which boards of different thicknesses may be expected to give,

and from this estimate to determine more or less closely a theoretical economic value per unit of surface for each thickness. In making this estimate of the service or utility value of boards of varying thicknesses, the large uses of lumber already discussed must be considered. Weight should be given to each thickness in proportion to the amount of lumber used for those purposes for which that thickness is best suited. In doing this it must be recognized that within practical limits the thicker material is better for all uses, but not in all cases in proportion to its cost.

A comparison may then be made between the relative service to be expected from boards of different thicknesses and the theoretical cost per unit of surface. This comparison indicates that the most economical thickness for inch boards is in the neighborhood of $\frac{7}{8}$ inch. It indicates further that in thicknesses greater than $\frac{7}{8}$ inch economy or efficiency in use is less, but only in a slight degree, and that in thicknesses less than $\frac{7}{8}$ inch economy in use falls off to a degree which rapidly becomes marked as the thickness decreases.

This point of most economical thickness is arrived at primarily through a consideration of a number of factors some of which, being based on judgment and experience, are somewhat intangible. Greater weight should perhaps be given to the more tangible factors which enter into the utilization of inch boards, such as the immediate saving from lower cost of manufacture and decreased freight charges. In addition, there is a slow tendency in the utilization of lumber to change design so as to permit the use of thinner sizes. The combined weight of these factors indicates that the thickness for maximum economy may be reduced somewhat to obtain a permanent standard.

The amount which the thickness for maximum economy may be reduced because of these considerations can not be determined by test but must again be deducted from the mass of data available with full reliance on judgment and experience in interpreting them. On this basis it is believed that a reduction of $\frac{1}{16}$ inch to $\frac{13}{16}$ inch is justified. Furthermore the comparison between relative service and theoretical cost indicates that between the thickness for maximum economy and $\frac{13}{16}$ inch, the decrease in economy or in what might be called the relative efficiency of different thicknesses of lumber is slight. Below $\frac{13}{16}$, however, the increasing rate of loss in efficient use would be so great as to make it questionable whether or not any standard for inch boards less than $\frac{13}{16}$ could be permanently justified.

Therefore $\frac{13}{16}$ inch is believed to be the most suitable thickness for inch boards surfaced two sides when seasoned to the proper moisture content for the use intended, and to represent under present conditions the thickness which, for the ordinary uses to which such boards are put, will give the maximum of satisfaction per unit of cost.

THICKNESS OF "TWO-INCH" DIMENSION.

The thickness of 2-inch dimension for maximum efficiency is dependent upon several factors somewhat different from those involved in the case of 1-inch lumber. The chief uses of 2-inch dimension are for framing of buildings, planking, and, in the case of lower grades, for crating. Thus, strength and uniformity of size are the principal requirements. On account of the relatively enormous consumption for joists and studding, those uses should govern the thickness of 2-inch stock.

JOISTS.

The formulas of mechanics would seem to indicate that the higher and thinner the section of a joist the better, up to a point where shear failure occurs. The formulas are, however, based on a section thick enough to resist buckling and overturning. When no lateral support is received, this is a ratio of about 2 to 1. Because of the floor and bridging, joists can have much greater ratios than this. With 16-inch spacing of joists and ordinary bridging, ordinary 2 by 8's (1⅝ by 7½ inches) and 2 by 10's (1⅝ by 9½ inches) are satisfactory. In widths greater than 12 inches, the use of 1⅝-inch material is questionable.

It appears, therefore, that the demands made upon 2-inch dimension for use as joists will be properly met by a dry finished thickness of 1⅝ inches for widths up to and including 12 inches. A thickness greater than this would add to the cost without increasing its usefulness.

STUDDING.

The majority of small-house walls are made with studding 1⅝ by 3⅝ inches, placed 16 inches center to center. If the studding were more than 3⅝ inches wide, greater stiffness would be obtained and the thickness might apparently be reduced. However, since the thickness of 1⅝ inch has been found best suited for use in joists, it should govern in studding and the width should conform to it. Moreover, 3⅝ inches is an economical width. A reduction below 3⅝ inches would call for an increase in the thickness which would more than offset the gain.

NAILING.

In both joists and studding good nailing properties are required. In driving nails into the ordinary 2 by 4 stud in position, there is a considerable amount of spring, except near the floor or ceiling. This spring increases the work of driving the nail and at times damages the plastering on both sides of the wall. A studding thinner than 1⅝ inches or narrower than 3⅝ inches will spring easily, and it will require a harder blow with the hammer to drive the nail, thus increasing the danger of damage to the wall.

The studs and joists should also be of sufficient thickness to permit of proper nailing without splitting. If a joist or stud is split at the nail, not only is the joist or stud weakened, but the nail has no holding power. The likelihood of splitting increases as the thickness decreases. To insure against splitting when ordinary care is used 1⅝ inches is sufficient. Thinner joists and studding will require more care on the part of the carpenter and thus tend to increase the cost of construction. Thicker material would increase the cost without increasing the service obtained.

WIDTHS OF "ONE-INCH" BOARDS AND "TWO-INCH" DIMENSION.

The greater the width of lumber the greater its value for practically any use. In general, widths should be the maximum obtainable under best methods of manufacture. Moreover, widths of 1-inch and 2-inch lumber should be the same for each nominal size, because the two thicknesses are often used together and a uniform finished size is advantageous to use.

EFFECT OF PRESENT MANUFACTURING PRACTICE ON SIZES.

VARIATION IN SAWING.

Under the best conditions of manufacture there is a limitation to the accuracy with which lumber may be sawed. Measurements made by the Forest Service on several hundred thousand feet of lumber at numerous softwood mills located in every lumber-producing region of the United States have shown an average variation from the exact size intended of $\frac{1}{16}$ inch in thickness and $\frac{1}{8}$ inch in width. This variation may be due to a large number of factors, but whatever the cause, a certain amount of variation is unavoidable and must be taken into consideration in arriving at standard sizes.

SHRINKAGE.

A second factor which must be considered in fixing sizes is shrinkage. As it is to the consumer's advantage to have lumber seasoned before it is dressed and shipped, and since seasoned lumber contains the same amount of wood substance after drying as before, even though the total volume has decreased, a reasonable allowance for shrinkage from the green condition should be made in determining the dry sizes of lumber.

Field tests made at numerous mills located in every producing region of the United States indicate the average shrinkage per inch in the ordinary period of air seasoning to be $\frac{1}{32}$ inch for all softwood species. Individual specimens within a species may show greater or less shrinkage than this, but the difference between the average for different species is so slight as to be negligible. This shrinkage of $\frac{1}{32}$ inch per inch was found in the ordinary thickness and in the narrow widths of yard lumber. On wide widths, however, the shrinkage per inch was found to be less, probably because of various seasoning factors.

The results of field tests on shrinkage have been compared with laboratory data based upon tests of many thousand specimens of wood measured and shrunk under accurate laboratory conditions, and have been found to check closely. These tests show that the average shrinkage per inch for softwood lumber does not exceed 3 per cent and that the variation between the average for different softwood species is not over 1 per cent. In board measurement this percentage would be $\frac{1}{32}$ inch and the variation $\frac{1}{100}$ inch, an amount so small as to be negligible. Laboratory tests show further that, even under the most careful conditions of seasoning, the shrinkage in width on wide boards is proportionately less than on narrow stock. Shrinkage on hardwood is often much greater than on softwood. The conclusions arrived at are applicable to softwoods only.

WOOD REQUIRED FOR DRESSING.

The third factor which enters into the finished size of lumber, and one also of much importance, is the minimum amount of wood necessary for dressing lumber so as to produce smooth surfaces and tight joints. Numerous field tests at mills maintaining a fair standard of practice have shown that to do this properly with high-speed machines, using lumber with the usual variation in size, requires for dressing two sides $\frac{3}{32}$ inch in thickness. Occasionally a piece may fail to dress smooth over the whole surface because of scantness in

thickness, or because of warping, but such material may be reworked into products permitting a thinner finished size, or degraded in accordance with the grading rules. Some mills were found at which dressing was done on a minimum of $\frac{2}{32}$ inch, but the quality of work was not such as to recommend so small an allowance.

The field studies show that in order to dress finishing and common boards and dimension on the edges a minimum of $\frac{1}{8}$ inch is required. In dressing the edges of lumber to produce tight tongue-and-groove or rabbet joints, an additional $\frac{1}{8}$ inch is customarily required.

METHOD OF SAWING.

The general system of sawing employed also influences the finished size of yard lumber. In mills which cut small logs and in which the three primary operations of sawing, edging, and trimming only are performed, sawing instruction can easily be varied. A certain average thickness and width can be obtained for each nominal size, or variations may be made on certain qualities or to fill special orders. In such mills, however, efficient operation demands that the widths be cut sufficiently in excess of nominal size to permit of subsequent ripping if the occasion should demand it. At mills cutting large logs where the head saw is used merely to break the logs down into units which secondary equipment can handle, there is possibly less flexibility. Furthermore, when a large percentage of the cut is made up of timbers, the nominal widths of boards must be more closely adhered to, because many of them are produced in sizing up the timbers or by resawing rejected timbers.

SUMMARY OF MANUFACTURING PRACTICE.

The various conditions of manufacture mentioned indicated that the following sizes are the maximum which may be obtained from lumber cut to the full nominal size in the rough green condition.

For 1-inch lumber the variation in sawing is $\frac{1}{16}$ inch, the shrinkage $\frac{1}{32}$ inch, and the necessary thickness for dressing two sides $\frac{3}{32}$ inch, making a total of $\frac{3}{16}$ inch. The maximum dressed thickness that can be cut from 1-inch lumber when seasoned to the proper moisture content for the use intended is, therefore, $\frac{13}{16}$ inch. On 2-inch material the slightly greater shrinkage and larger requirements for dressing indicate that $1\frac{3}{4}$ inches may be obtained from material cut a full 2 inches in the rough green.

In determining the standard widths of lumber, the same elements must be considered as for thickness. Variation in sawing has been found to be $\frac{1}{8}$ inch on all widths, and the amount of material necessary for ordinary dressing on the edges about $\frac{1}{8}$ inch. In the matter of shrinkage, however, an allowance of $\frac{1}{32}$ inch per inch of width would give a different total shrinkage, and thus a different finished size, for each width. Such a situation would be inadvisable from the manufacturers' as well as from the distributors' standpoint. Therefore, widths are divided into two groups, one group up to and including 7 inches and the other 8 inches and above. In the first group an allowance for shrinkage of $\frac{1}{8}$ inch is made. In the second group an allowance of $\frac{1}{4}$ inch is made. Thus the total allowance for variation in sawing, shrinkage, and dressing on the edges, for boards and dimension up to and including 7 inches in width, is $\frac{3}{8}$ inches. The allowance for boards and dimension 8 inches and over is $\frac{1}{2}$ inch.

This allowance is sufficient for ordinary dressing, but where a tight-fitting tongue-and-groove or rabbet joint is required on sizes 7 inches or less in width, an additional $\frac{1}{8}$ inch of wood must be removed.

CONCLUSIONS.

From a careful weighing of all elements of the problem as set forth above, the following conclusions are reached:

That, to secure a reasonable degree of satisfaction for requirements of use, $\frac{13}{16}$ inch is the minimum finished thickness for 1-inch boards seasoned to the proper moisture content for the uses to which they are to be put.

That lumber $1\frac{5}{8}$ inches thick for finished 2-inch dimension, seasoned to the proper moisture content for the uses to which it is to be put, will satisfactorily meet the strength requirements of joist and studding, which uses govern the thickness of dimension, and that sizes in excess of $1\frac{5}{8}$ inches are wasteful.

That dressed widths of 1-inch lumber and 2-inch dimension, seasoned to the proper moisture content for the uses intended, be $\frac{3}{8}$ inch scant on widths up to 7 inches and $\frac{1}{2}$ inch scant on wider widths, and that they should be of uniform size for each nominal width of 1-inch and 2-inch lumber.

SIZES RECOMMENDED FOR YARD LUMBER.

The foregoing conclusions are used as a basis for determining the finished dimension for the various nominal sizes of the different forms of yard lumber. Such modifications are made for each form as are required by the specific use to which it is put or as are demanded by good manufacturing practice.

There are so many nominal sizes for each of the products described that only the principles involved in establishing the important sizes of each will be enumerated here. The complete list of sizes for each will be found under the specifications covering each product and in the "Summary of sizes for yard lumber."

MOISTURE CONTENT ON WHICH SIZES ARE BASED.

The sizes prescribed are predicated upon lumber seasoned to the proper moisture content for the use to which it is to be put. This moisture content varies with the form of lumber and the species from which it is cut. For those forms of yard lumber which are customarily air dried, such as common boards or dimension, this moisture content shall be considered 15 per cent; for those forms which are customarily kiln-dried, such as flooring and drop siding, it shall be considered 8 per cent.

FINISHING.

Finishing is lumber of select quality. It is not cut to a particular pattern, but derives its name from the fact that a large quantity of it is used for interior and exterior trim of dwellings. Finishing lumber should be of maximum size obtainable from lumber cut to the full nominal size in the green condition. Two-inch finishing lumber in particular has uses which demand a greater thickness than 2-inch dimension. Therefore the dressed sizes shown for Finishing are the maximum which may be produced under best manufacturing conditions as previously discussed.

COMMON BOARDS SURFACED TWO SIDES.

Common boards surfaced two sides have a vast number of uses which require the properties discussed under the subject of 1-inch lumber. The sizes prescribed are the same as those for 1-inch boards and 2-inch dimension.

COMMON BOARDS DRESSED AND MATCHED.

Common boards dressed and matched are used for sheathing, subflooring, concrete-form material, and partitions where knots are not objectionable. For these purposes they require a fair degree of stiffness and comparatively smooth dressing. Smoothness may be obtained by dressing to $\frac{3}{4}$ inch. Furthermore, this size permits of using material which would fail to dress to the size recommended for 1-inch boards, dressed two sides, thus permitting closer utilization of lumber. They should, moreover, be well dressed on the edges so as to produce reasonably tight joints; therefore the over-all widths are prescribed $\frac{1}{2}$ inch less than the nominal. Since the tongue is ordinarily $\frac{1}{4}$ inch wide, the face width for 1-inch nominal thickness will be $\frac{1}{4}$ inch less than the over-all widths.

COMMON BOARDS WORKED SHIP-LAP.

Common boards dressed and rabbeted are used for sheathing, subflooring, subroofing, barn siding, and, in some localities, concrete forms. They require strength and stiffness to a large degree for these purposes. Since this can not be secured by a lapped joint, it must be supplied in thickness. Therefore ship-lap should have the maximum thickness obtainable from rough lumber. The rabbet should be $\frac{3}{8}$ inch wide in order that shrinkage of the piece may not cause opening at the joints. The over-all widths are $\frac{1}{2}$ inch less than nominal and face widths $\frac{3}{8}$ inch less than the total widths in 1-inch nominal thickness to provide for the lap. The thickness of the lap is one-half the thickness of the piece.

DIMENSION.

The principles involved in establishing dressed sizes for dimension have been previously discussed.

FLOORING.

Flooring requires the qualities of strength, stiffness, and resistance to wear. It should be of the maximum thickness obtainable from the nominal size. The necessity for tight joints and freedom from wane on the face indicates that this material should conform in width to the general rule for dressed and matched lumber. In the narrow widths, such as 2 and 3 inches, however, the total shrinkage is less, and it is easier to bend the lumber edgewise when going through the planing machines. Furthermore, these widths are very often produced from strips ripped from lumber of wider widths. These factors make it possible to dress flooring 2 and 3 inches wide so as to be $1\frac{1}{2}$ and $2\frac{3}{8}$ inches wide on their faces, respectively.

CEILING AND PARTITION.

Ceiling is used for covering and decorative purposes. It is ordinarily manufactured in nominal thicknesses of less than 1 inch and should follow the general rule for such thicknesses. Partition is

ordinarily used for decorative purposes, but in situations where both sides are visible. It may also require a certain amount of strength. For these reasons it is ordinarily manufactured in 1-inch nominal thickness. A finished size of $\frac{3}{4}$ inch has been found sufficient for strength demands ordinarily made upon it. This size further permits of dressing both sides of the lumber clean, as is required for such use, and makes possible a saving of freight. It is therefore prescribed as the standard finished thickness for ceiling and partition of 1 inch nominal size.

The requirements of manufacture in regard to widths are the same for these products as for flooring. Furthermore, it is good practice architecturally to have ceiling and partition the same width as flooring in the same room. Therefore, the same widths are prescribed for ceiling and partition as for flooring.

SIDINGS.

Sidings are used for protective and decorative purposes on the exterior of buildings. They are usually applied over sheathing, although they may be applied directly over framing. The main purpose is to keep out air and water. Thickness is not of great importance from a use standpoint and should be such as to permit of efficiency in manufacture, with due consideration for the matter of economical lumber distribution.

Drop sidings are produced by dressing select or common lumber to a pattern on the face and so as to produce a tight tongue-and-groove or lapped joint on the edges. They are nailed directly on sheathing or studding and hence are not so liable to warp. Thin and waney-edged lumber can be used economically in their manufacture. Therefore, a thickness of $\frac{3}{4}$ inch at the thickest point is prescribed. In width, drop sidings follow sizes prescribed for dressed and matched and ship-lapped boards.

Beveled siding is manufactured from boards dressed four sides and sawed on a bevel so as to produce two pieces of siding. If 1-inch lumber is dressed to $\frac{13}{16}$ and sawed with a saw cutting a kerf of $\frac{1}{8}$ inch, two pieces of siding $\frac{3}{16}$ inch thick on one edge and $\frac{1}{2}$ inch thick on the other will be produced. This size is prescribed as standard for siding of $\frac{1}{2}$ inch nominal size. The width of beveled siding is prescribed as $\frac{1}{2}$ inch less than full nominal width. The $\frac{5}{8}$ inch nominal siding is ordinarily produced by bevel sawing 5/4 inch material. The common thickness for $\frac{5}{8}$ inch bevel siding is $\frac{3}{16}$ inch on the thin edge and $\frac{5}{8}$ inch on the thick edge.

CASING AND BASE.

Casing and base are used for covering and decorative purposes. These uses require strength and stiffness to a limited extent, but more particularly they require smooth finish and freedom from wane. Furthermore, casing and base are often reworked from finishing lumber. For these reasons, a finished thickness of $\frac{3}{4}$ inch for 1-inch lumber and a width of $\frac{1}{2}$ inch scant of nominal size are prescribed.

FACTORY FLOORING, HEAVY ROOFING, DECKING, AND SHEET PILING.

The products named are ordinarily manufactured from dimension lumber and should be dressed to the same thickness as dimension. On the edges these products may be dressed and matched, worked

ship-lap, or grooved for splines. Since the tongue or lap on thick material must be longer than on 1-inch lumber, dressed and matched material and material worked ship-lap have face widths $\frac{1}{8}$ inch less than common boards worked in the same manner. The face width of the material grooved for splines is $\frac{1}{2}$ inch scant of the nominal width.

PARTIALLY DRESSED LUMBER.

It is a practice of certain mills to dress certain forms of lumber, such as dimension, only partially, as on one side and one edge. Some buyers prefer to purchase their lumber this way. Lumber surfaced one side, one edge, or one side and one edge should be of the same size as lumber dressed two sides, two edges, or four sides, respectively, because other sizes for such lumber would destroy the benefits of standardization. However, an agreement may be made between the buyer and seller providing for a dressed size sufficient to permit of further dressing by the buyer to the standard size for that product.

BASIS FOR STANDARD NOMENCLATURE.

NOMENCLATURE OF WOODS.

Localization of common names for lumber cut from different species and varieties of tree growth has caused great confusion among manufacturers and consumers of timber and its products. The sale of one kind of wood for another, due to lack of recognized standard names, whether it be a fault of the seller or purchaser or a misunderstanding, invites disagreeable complications, such as rejections, litigation, and forced acceptance by a customer. This often results in improper use of a wood and dissatisfied customers, and eventually it reacts against the entire industry through the use of substitutes. Furthermore, lack of standard names invites sharp practices by the unscrupulous.

The Forest Service recognizes certain common and scientific names for tree species as standard for use within the service. So far as possible these names conform to the most widely accepted customs and usage. They are published in Forest Service Bulletin 17, "Check List of the Forest Trees of the United States, Their Names and Ranges." Changes made since 1898, when this bulletin was published, have been few. A revised publication including the changes and a number of new species is now being prepared. It is possible that this may necessitate minor changes in the standard nomenclature recommended in this publication.

In the nomenclature recommended in this circular, as standard for lumber cut from the various species, additional explanatory words for some woods are included in parentheses. In any case where there is a doubt as to the wood meant, these explanatory words should be used to avoid confusion. When a seller of wood includes wood of one species under the standard name of some other species, the fact should be made known to the purchaser.

Names recommended as standard in this report are for the common commercial softwood species only. Other names under which lumber cut from each species is sometimes sold are listed, but their use is not recommended. Recommended names for minor softwood species and for the hardwoods are given in Bulletin 17 above mentioned.

NOMENCLATURE OF GRADES.

In order to make standard grading rules effective, it is necessary that grade names be unified. There is little advantage in maintaining uniform grades if a certain quality of lumber is given one name by one association and a different one by another.

Since the basic grades for yard lumber, as recommended in this report, distinguish two main divisions in quality, Select and Common, the subdivisions of these major divisions are assigned grade names which indicate the relative position of the grade in the quality scale of each division. At the same time, these designations are distinctive and preclude any possibility of confusion between different grades. A survey of grade names now used indicates that common lumber is almost invariably given numerical designations coupled with the word "common." It further indicates that the majority of the large regional associations use letters in designating the select grades. Eight out of eleven of the largest lumber manufacturing associations use alphabetical designations for the upper grades. The other three use letters in designating some of the products of certain species, or the alphabetical and numerical designations for their regular grades in certain markets.

For these reasons, the select basic grades are designated as A, B, C, and D, and the common grades as Nos. 1, 2, 3, 4, and 5 Common. Calling the highest grade No. 1 and the lowest No. 9, as has been suggested at times, would produce a psychological effect which would react against the sale of common lumber.

In the designation of standard grades, the name of the product is added to the name of the basic grade. Thus, flooring grades would be named A Flooring, B Flooring, No. 1 Common Flooring, etc.

Combination grades, such as B and Better and C and Better, or combinations of common grades under names such as "Merchantable" or "Construction" may be used, provided they conform to the instructions covering mixed grades as recommended under standard shipping practices for yard lumber. The practice of making combination grades, however, should be discouraged.

BASIS FOR STANDARD GRADE MARKS.

Grade marking of lumber is praiseworthy in that it serves as one of the seller's guarantees of quality. It is also fundamental to a correct understanding of lumber grades, to the proper and satisfactory use of the material, to the consumer's good will, and to the future prosperity of the lumber industry.

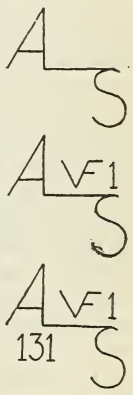
In the past, lumber has been marked in nearly all cases to designate the mill grade, largely for the benefit of certain classes of mill employees. In a few cases the lumber has been branded for the benefit of the consuming public. There has been no widespread movement, however, designed to establish definite grade marks which would be simple of application and readily understood by the consumer. In view of the fact that suitable machinery for branding lumber under all conditions has not as yet been developed, it may not at all times be feasible to brand each individual piece with a steel die or heavy ink. The grade marks which are applied, however, should be standard

for each grade, irrespective of species or regions from which the material was produced or shipped.

Probably the most satisfactory method of marking, from the standpoint of the consumer, would be to place the grade name directly on the lumber rather than some individual mill mark representing the grade and product.

There are two types of marks worthy of consideration, first, a mark indicating the product, and second, the grade mark. A monogram mark combining a V and an F might represent a product such as vertical grain flooring, while the mark B, for example, following the product mark would indicate the grade.

A grader working under normal high-speed production will seldom have time to put more than the grade mark on a piece, although when machinery is used both the product and grade mark will be possible of application. Furthermore, both the product and grade mark may not be necessary unless there is a possibility of confusion as to rules under which it should be graded, or unless there is a possibility of changing the grade through further manufacture. A piece of No. 1 Dimension, for example, and a piece of No. 1 Structural might not be the same grade even though the same size; a 2-inch piece of No. 1 Dimension would not necessarily make two No. 1 Common boards if resawed; and pieces of flat grain flooring showing a high percentage of vertical grain might be sold as vertical grain flooring. There is less opportunity for grade manipulation of products worked to a numbered pattern or to a special pattern, such as thin ceiling.



Mills or shippers selling lumber according to American lumber standards should, when economically feasible, brand the lumber as such. A central organization should copyright a symbol and every mill or shipper have a number assigned to him. A monogram insignia with which the grade and product mark as well as a number identifying the mill may be combined is recommended. The accompanying mark is suggested for the purpose.

SHIPPING WEIGHT OF LUMBER.

The weight of 1,000 feet b. m. of any species of lumber depends upon several variable factors, such as the density and moisture content of the wood, the grade of the lumber, and the form in which shipped, whether rough or dressed. This large number of variables gives rise to a large number of weights for different forms and species of lumber. Although a different weight for each will always be necessary, the present situation is unsatisfactory and should be given more careful consideration. Sufficient data on which to establish standard weights for lumber are not now available, but a study of the factors enumerated and a compilation of railroad weights for straight carload shipments of lumber should furnish data on which to establish standard weights.

DENSITY.

The density of wood substance, not including the air spaces in fibers and pores, may be considered uniform for all species of trees with a specific gravity value of 1.54. The greater the amount of wood substance in a cubic foot, therefore, the closer it approximates the maximum specific gravity of 1.54. The density of wood may vary at different diameters and at different heights in the tree. This fact has an important bearing on the average weight per thousand feet of products customarily cut from certain parts of a tree. In a mature tree the material which is cut from the portion which grew during the period of optimum growth will customarily be heavier than the material cut from a portion which preceded or followed optimum growth. Furthermore, the clear material which is cut from the butt log of a tree may be heavier and denser than clear material cut from a top log.

MOISTURE CONTENT.

The amount of moisture in green wood varies greatly in the different kinds of woods. In the softwoods, as a rule, the moisture content of heartwood and of sapwood varies, and sometimes a variation exists between the lower and upper parts of the tree. Cypress and tamarack are exceptions, in that they have a comparatively uniform moisture content throughout the tree. In the case of western larch and sugar pine, the butts are frequently heavy, because of moisture and resin. In longleaf pine and some other species the moisture content of the heartwood is low, but the sapwood is very wet. The hardwoods contrast with the softwoods in that, as a rule, they show a fairly uniform distribution of moisture throughout the tree. In small quantities of wood the variation in weight may be great, due to the fact that the moisture content may vary from 4 to 200 per cent of the dry weight of the wood.

Variations of 4 per cent above or below the average weight for wood in the green condition for any species which has its moisture content uniformly distributed may be expected in any lot of material of that species. In species that do not have a uniform distribution of moisture, a variation from 8 to even 30 per cent in exceptional cases in the weight of the wood in the green condition may be expected.

A variation of 4 per cent from the average weight for wood air-dried to 12 per cent may be expected in any lot of material dried to that moisture content. A lesser variation will be found in lumber kiln-dried to 8 per cent moisture content.

GRADE OF LUMBER.

The grade of lumber also influences its weight. Grades permitting knots will be heavier than clear grades, because the weight of the wood in the knots is from two to three times that of the clear wood. Grades permitting large quantities of pitch are heavier than other grades. Low grades permitting decay to any degree are ordinarily lighter than grades of sound wood. Generally the weight of select grades of lumber is close to that of clear wood, the better common grades are heavier, and the lowest common grades are lighter.

FORM IN WHICH LUMBER IS SHIPPED.

In addition to the factors previously discussed, the average thickness and width to which lumber is cut in the sawmills influences its weight per 1,000 feet b. m. when shipped rough. One mill may saw 1-inch boards $\frac{15}{16}$ inch thick while another saws the same species $1\frac{1}{16}$ inches thick. Obviously, the lumber from the second mill will be about $\frac{1}{8}$ heavier than the first. Again there may be a difference between mills in the average widths, or at the same mill narrow widths may be sawed to exact sizes and wider widths sawed $\frac{1}{2}$ inch in excess of nominal widths with a corresponding increase in weight.

The most important variable in the shipping weight of lumber is the size or pattern to which it is dressed. Comparatively little yard lumber is now shipped in the rough. The size to which it is dressed varies in different associations and, within each association, for each lumber product. Differences in thickness of $\frac{1}{16}$ inch on boards dressed two sides may make a difference of 150 pounds per 1,000 feet b. m. Dressing to a pattern, such as drop siding, may make a difference of several hundred pounds less than lumber S2S. Dressing on the edges also reduces the weight, and different width lumber may have different weights. Four-inch boards S4S to $3\frac{5}{8}$ inches would weigh less than full width boards by about 10 per cent, while 12-inch boards dressed to $11\frac{1}{2}$ inches wide would be only about 4 per cent less in weight than full 12-inch material.

The Forest Products Laboratory has determined the average weight per cubic foot of the principal American species in the green, air-dry, and kiln-dry condition. It is possible that the influence of all the factors mentioned upon weight of lumber might be determined and shipping weights per 1,000 feet b. m. obtained from the data available. However, the results would require checking against actual weights of lumber as shown by railroad weights. This work has not yet been done, but is fully justified by the importance of standard shipping weights.

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PART II.—RECOMMENDED SPECIFICATIONS FOR YARD LUMBER.

BASIC GRADES FOR YARD LUMBER.

GENERAL INSTRUCTIONS.

(1) The terms "softwoods" and "hardwoods" are the most generally accepted names for two different classes of trees, otherwise known as "trees with broad leaves" and "trees with needles or with scalelike leaves."

(2) The specifications for yard lumber were prepared primarily to cover softwoods. Field studies to determine the practical application of the specifications to hardwoods have not yet been made, but it appears from the available information that the basic and standard grades as stated herein are applicable to such hardwood lumber as is cut into the same products and for the same uses as softwood yard lumber. The grades are not designed for factory or shop lumber based on size and quality cuttings.

(3) The purpose of basic grading rules for yard lumber is to harmonize into grades of equal quality lumber manufactured in various regions from the same or different species of wood, used for the same general purposes.

(4) The term "yard lumber" as here used means lumber that is manufactured and classified into those sizes, shapes, and qualities required for ordinary domestic and industrial uses. Heavy timbers for structural purposes, softwood factory lumber, hardwood factory lumber, and other special-use materials are not considered yard stock.

(5) On the basis of quality yard lumber is divided into two main divisions, Select lumber and Common lumber. These are each divided into two classes—Select lumber into that suitable for natural finishes and that suitable for paint finishes, and Common lumber into that which can be used without waste and that which permits some waste. Each of these four classes is further divided into quality classes or grades. The requirements of each subclass must be kept in mind by the grader as well as the limitations of the grade itself. In interpreting the basic grades the definitions of defects and blemishes given in this circular should be used.

(6) Nine basic grades are described. Other basic grades will be considered special. When it is impracticable to sort stock into this number of grades, such of the basic grades may be used as will best fit the manufacturing practices of the producing region concerned.

(7) The standard grades of yard stock products, such as flooring and siding, will conform to the basic grading specifications, with such modifications as are required by the use intended or may be permitted in the interests of conservation. Grades other than those described shall be considered special. In making shipments under the standard grading rules the suggested shipping instructions contained in this circular should be used.

(8) The grade of lumber, rough or surfaced two sides, shall be determined from the best side of the piece, except in dimension lumber. Lumber which is surfaced one side only shall be graded from the surfaced side. The reverse side of the piece in either case should not be of such a nature as to interfere with the use of the piece in the grade intended. The reverse side in the higher grades should more nearly approach the best side in quality.

(9) The rules prescribe the number and extent of defects and blemishes permitted in the poorest pieces admissible in each grade, though a series of defects may be described as admissible in some grades the very nature of which would prevent all of them from appearing in one piece. A shipment of any grade should contain all the lumber produced from the log the quality of which is between the lower limit of the grade and that of the next higher grade recognized.

(10) Imperfections in rough stock which can be removed in dressing to standard size shall not be considered in determining the grade under these rules.

(11) The number of defects and blemishes permitted varies as the area of the piece to be graded increases or diminishes in respect to the standard size specified, but the size of the defects must not exceed that allowed by the grading rules. Defects should be well distributed.

(12) When defects or blemishes not described in these grading rules are encountered, they will be considered as equivalent to known defects according to their damaging effect upon the piece in the grade under consideration. It must be recognized, too, that a combination or extent of described defects may exist which may be considered equivalent to defects specified.

GRADING RULES.

Diagrammatic summary of the basic grades for yard lumber.

- Total product of a typical log arranged in series according to quality as determined by appearance.
  - SELECT. Lumber of good appearance and finishing qualities.
    - Suitable for natural finishes.
      - Grade A—Practically free from defects.
      - Grade B—Allows a few small defects or blemishes.
    - Suitable for paint finishes.
      - Grade C—Allows a limited number of small defects or blemishes that can be covered with paint.
      - Grade D—Allows any number of defects or blemishes which do not detract from a finish appearance, especially when painted.
  - COMMON. Lumber containing defects or blemishes which detract from a finish appearance but which is suitable for general utility and construction purposes.
    - Lumber suitable for use without waste.
      - No. 1 Common—Sound and tight knotted stock. Size of defects and blemishes limited. May be considered water-tight lumber.
      - No. 2 Common—Allows large and coarse defects. May be considered grain-tight lumber.
    - Lumber permitting waste.
      - No. 3 Common—Allows larger and coarser defects than No. 2 and occasional knot holes. Seventy-five per cent as good as No. 2 Common.
      - No. 4 Common—Low quality lumber admitting the coarsest defects, such as rot and holes. Fifty per cent as good as No. 2.
      - No. 5 Common—Must hold together under ordinary handling.

SELECT GRADES.

(14) Lumber which is generally clear, containing defects limited both as to size and number, and which is smoothly finished and suitable for use as a whole for finishing purposes or other uses in which large clear pieces are required, shall be considered as Select lumber.

Two classes shall be recognized. The first shall be suitable for natural finishes. Defects and blemishes permitted in this class must be localized in nature. The second class permits similar defects and, in addition, blemishes of somewhat greater extent than those of the first class, but of a type which can be covered by paint.

(15) These grades are based on a piece 8 inches wide by 12 feet long, or a piece which contains 8 square feet, surface measure.

(16) Grade names: A, B, C, and D.

GRADE A.

(17) Grade A shall be free from defects on the face side of pieces up to and including 12 inches in width. Widths greater than 12 inches will admit two or combination of two of any of the following defects:

Sound and tight pin knot.
Small pitch pocket.
Small surface check.
Slight crook.
Slight wane.
Bird's-eye.

GRADE B.

(18) Grade B shall possess natural finishing qualities, but will admit two or combination of two of any of the following defects:

Short split.
Fine shake—equal in length to width of piece.
Three small surface checks.
Medium wane.
Small crook.
Slight cup.
Medium sound and intergrown knot.
Three sound and tight pin knots.
Small pitch pocket.
Three very small pitch pockets.
Small pitch streak.
Pin wormholes—one per surface foot.
Light discoloration—5 per cent of area.
Firm red heart—5 per cent of area.
Patch slight torn grain.
Chipped grain.
Bird's-eye.

GRADE C.

(19) Grade C shall possess finishing qualities, but will admit any four or combination of four of any of the following defects:

Short split.
Fine shake—equal in length to width of piece.
Three small surface checks.
Medium wane.
Small crook.
Slight cup.
Medium sound and intergrown knot.
Small encased knot.
Three sound and tight pin knots.
Small pitch pocket.
Three very small pitch pockets.
Medium pitch streak.
Pin wormholes—two per surface foot.
Medium discoloration—10 per cent of area.
Firm red heart—10 per cent of area.
Pith—3 inches in length.
Patch medium torn grain.
Slight skip.
Bird's-eye.

GRADE D.

(20) Grade D shall be of Select Common quality and possess a finishing appearance, but will admit any number of the following defects and blemishes. More serious defects shall be permitted on the reverse side, but no combination so serious as to prevent its use for the purpose intended:

Short split
Fine shake.
Medium surface check.
Medium wane.
Small crook.
Slight cup.
Medium sound and intergrown knot.
Small encased knot.
Pin knot.
Medium pitch pocket.
Medium pitch streak.
Pin wormholes—two per surface foot.
Medium discoloration—10 per cent of area.
Firm red heart—10 per cent of area.
Pith—3 inches in length.
Patch medium torn grain.
Slight skip.
Bird's-eye.

(21) Pieces containing one serious defect, such as a loose knot or knot hole not more than 2 inches in diameter located more than 32 inches from either end, may be permitted, provided the rest of the piece is of B or better quality.

COMMON LUMBER.

(22) Lumber containing numerous defects and blemishes which preclude it from use for finishing purposes, but which is suitable for general utility and construction purposes, shall be considered common lumber.

Two general classes shall be recognized. The first shall be suitable for use as a whole for purposes in which surface covering or strength is required. Defects and blemishes permitted in this class must be sound. The second class permits very coarse defects which may cause waste in the use of the piece.

(23) Grade names: No. 1 Common, No. 2 Common, No. 3 Common, No. 4 Common, and No. 5 Common.

NO. 1 COMMON.

(24) No. 1 Common shall present a generally smooth appearance and be high-class general utility lumber. It permits any number of the following defects not in serious combination:

Sound and intergrown knots—1½ inches in diameter in 4-inch and 6-inch widths, 2 inches in 8-inch and 10-inch, 2½ inches in 12-inch, and not over 3 inches in wider widths.
Black and encased knots—one-half the diameter of sound and intergrown knots permitted up to a maximum diameter of 1¼ inches, provided the knot be sound and immovably fixed in position.
Short split.
Slight shake that does not go through, equal in length to width of piece.
Surface checks.
Medium wane.
Small crook.
Medium cup.
Large pitch pockets which do not show an opening through the piece.
Large pitch streak.
Pitch.
Pin wormholes well scattered.
Medium discoloration.
Firm red heart.
Pith—one-sixth the length of piece.
Patch heavy torn grain.
Slight skip.
Medium cross grain.

NO. 2 COMMON.

(25) No. 2 Common permits any number of the following defects, but no combination of them so serious as to prevent the use of each piece as a whole, except as noted:

Sound and tight knots—2½ inches in diameter in 4-inch and 6-inch widths, 3 inches in 8-inch and 10-inch, 3½ inches in 12-inch, and not over 4 inches in wider widths.
Unsound and pith knots—one-half the diameter of sound and tight knots permitted, provided the knot be fixed in position.
Spike or branch knots—which are sound and do not weaken the piece at any point more than the knots heretofore specified.
Medium split.
Through check or shake—one-sixth the length of piece.
Large wane.
Medium crook.
Large cup.
Large through pitch pockets—which do not show an opening greater than ⅛ inch wide by 3 inches in length.
Large pitch streak.
Pitch.
Small grub wormholes—maximum of one per surface foot.
Pin wormholes.
Heavy discoloration.
Firm red heart.
Advanced decay—not going through the board, equal in area to a streak ½ inch wide by one-sixth the length of piece.
Pith.
Patch deep torn grain.
Slight skips.
Heavy cross grain.

Pieces containing a loose knot or knot hole not more than 2 inches in diameter located more than 32 inches from either end may be permitted, provided the rest of the piece is of No. 1 Common quality.

NO. 3 COMMON.

(26) No. 3 Common permits numerous coarse defects, such as:

Large spike knots.
Loose or decayed knots or knot holes.
Excessive shake, checks, or splits.
Large wane or skips in dressing.
Advanced decay or heavy discoloration.
Excessive pitch defects.
Large grub wormholes.

It shall be suitable for use as a whole, or each piece shall contain not less than 75 per cent of material of No. 2 Common quality.

When defects occasioning waste, such as loose knots or knot holes, are permitted, they shall not be present in excess of the following:

One in lengths up to 10 feet.
Two in 12 and 14-foot lengths.
Three in 16-foot and longer lengths.

NO. 4 COMMON.

(27) The defects common to this grade are similar to those found in No. 3 Common, but exist to a greater degree.

The most common serious defects are knot holes, advanced decay or its equivalent in heavy massed pitch, and serious check. Other types are extremely coarse knotted, waney, shakey, badly split or checked.

NO. 5 COMMON.

(28) No. 5 Common is the lowest recognized grade and admits all defects known in lumber, provided each piece is strong enough to hold together when carefully handled.

STANDARD SPECIFICATIONS FOR YARD LUMBER.

FINISHING.

MATERIAL INCLUDED.

(29) Boards from $\frac{3}{8}$ to 3 inches thick and 3 inches and up in width, either rough or dressed one, two, or four sides, for uses in which a clear, smooth appearance is necessary, shall be graded as Finishing.

(30) STANDARD SIZES.

THICKNESSES.

Nominal thickness.	Dressed thickness S1S or S2S.
Inches.	*Inches.*
$\frac{3}{8}$	$\frac{5}{16}$
$\frac{1}{2}$	$\frac{7}{16}$
$\frac{5}{8}$	$\frac{9}{16}$
$\frac{3}{4}$	$\frac{11}{16}$
1	$\frac{13}{16}$
$1\frac{1}{4}$	$1\frac{1}{16}$
$1\frac{1}{2}$	$1\frac{5}{16}$
2	$1\frac{3}{4}$
$2\frac{1}{2}$	$2\frac{1}{4}$
3	$2\frac{3}{4}$

WIDTHS.

Nominal width.	Dressed width S1E or S2E.
Inches.	*Inches.*
3	$2\frac{5}{8}$
4	$3\frac{5}{8}$
5	$4\frac{5}{8}$
6	$5\frac{5}{8}$
7	$6\frac{5}{8}$
8	$7\frac{1}{2}$
9	$8\frac{1}{2}$
10	$9\frac{1}{2}$
11	$10\frac{1}{2}$
12	$11\frac{1}{2}$
14	$13\frac{1}{2}$
16	$15\frac{1}{2}$
18	$17\frac{1}{2}$
20	$19\frac{1}{2}$
Over 20	$\frac{1}{2}$ scant.

Standard lengths shall be 6 to 24 feet in multiples of 1 foot.

STANDARD SHIPPING PRACTICES.

RANDOM LENGTHS.

(31) The following percentages of short lengths shall be allowed in random length shipments unless otherwise agreed upon:

A, B, and C Finishing..	5 per cent 6 and 7 feet.
	5 per cent 8 and 9 feet.
D Finishing.....	5 per cent 6 and 7 feet.
	10 per cent 8 and 9 feet.

These percentages refer to the contents of a shipment in board feet.

GRAIN.

(32) The grain of Finishing may be either vertical, flat, or select. Selected flat-grain Finishing shall be chosen with special reference to the beauty of the figure of the wood.

STANDARD GRADES.

(33) Grade names: A Finishing, B Finishing, C Finishing, and D Finishing.

BASIS OF GRADE.

(34) The basis of grade shall be a piece 1 by 8 inches by 12 feet, or 8 surface feet.

COMPARISON WITH BASIC GRADES.

(35) Finishing grades shall conform to the basic grades in D and better grades, except as noted:

Standard grades.	*Basic grades.*
(36) A Finishing..	A grade.
(37) B Finishing..	B grade.
(38) C Finishing..	C grade.
(39) D Finishing..	D grade, except that the only pieces admitted in this grade must be selected with special reference to their use for finishing purposes. The reverse side of a piece may contain numerous serious defects provided the face of the piece shall retain the appearance of Finishing.

(40) SPECIAL PROVISIONS.

Wane may be increased in length under the multiple defect clause (see par. 11), but not in depth or width.

Pin wormholes shall not exceed in number two per surface foot in B grade, or eight per surface foot in C and D grades.

Discoloration or *firm red heart* shall not exceed 10 per cent of the area of any piece in B grade, or 40 per cent in C grade.

CASING AND BASE.

MATERIAL INCLUDED.

(41) High-quality material dressed four sides or molded for use as a casing or baseboard shall be graded as Casing and Base.

STANDARD SIZES.

PATTERNS.

(42) The thicknesses and widths of Casing and Base shall conform to the patterns shown in the Standard Molding Book.

LENGTHS.

(43) Standard lengths shall be 4 to 20 feet in multiples of 1 foot.

STANDARD SHIPPING PRACTICES.

BUNDLING.

(44) Molded Casing and Base shall be securely tied into bundles of equal length pieces.

RANDOM LENGTHS.

(45) Shipments of random lengths shall show an average length representing the average of the range of lengths ordered. The following percentages of short lengths shall be allowed in random length shipments unless otherwise agreed upon:

A, B, and C Casing or Base..	5 per cent 6 and 7 feet.
	5 per cent 8 and 9 feet.
D Casing or Base.....	5 per cent 6 and 7 feet.
	10 per cent 8 and 9 feet.

These percentages refer to the contents of a shipment in board feet.

GRAIN.

(46) The grain of Casing and Base may be either vertical, flat, or select. Selected flat-grain Casing and Base shall be chosen with special reference to the beauty of the figure of the wood.

STANDARD GRADES.

(47) Grade names: A Casing or Base, B Casing or Base, C Casing or Base, and D Casing or Base.

BASIS OF GRADE.

(48) The basis of grade shall be a piece 1 by 8 inches by 12 feet, or 8 surface feet.

COMPARISON WITH BASIC GRADES.

(49) Casing and Base grades shall conform to the basic grades in D and better grades, except as noted:

Standard grades.	*Basic grades.*
(50) A Casing or Base..	A grade.
(51) B Casing or Base..	B grade.
(52) C Casing or Base..	C grade.
(53) D Casing or Base..	D grade, except that the only pieces admitted in this grade must be selected with special reference to their use for casing or base purposes. The reverse side of a piece may contain numerous serious defects, provided the face of the piece shall retain a smooth finish.

(54) SPECIAL PROVISIONS.

Wane may be increased in length under the multiple defect clause (see par. 11), but not in depth or width. No wane shall be permitted on a molded edge.

Pin wormholes shall not exceed in number two per surface foot in B grade, or eight per surface foot in C and D grades.

Discoloration or *firm red heart* shall not exceed 10 per cent of the area of any piece in B grade, or 40 per cent in C grade.

MOLDINGS.

STANDARD SIZES.

PATTERNS.

(55) The thicknesses and widths of Moldings shall conform to the patterns shown in the Standard Molding Book.

LENGTHS.

(56) Lengths shall be 4 to 20 feet in multiples of 1 foot. No item of a shipment shall contain over 5 per cent of lengths under 8 feet.

STANDARD SHIPPING PRACTICES.

BUNDLING.

(57) Moldings shall be securely tied in bundles of equal length pieces. These bundles shall be of a size that may be easily handled and tallied.

RANDOM LENGTHS.

(58) Random length shipments of moldings shall allow of 5 per cent in board-foot measure of 6-foot and 7-foot lengths in shipments permitting short lengths. Four-foot and 5-foot lengths may be shipped on special agreement.

STANDARD GRADES.

(59) Grade names: A Molding, B Molding, and C Molding.

BASIS OF GRADE.

(60) The basis of grade shall be all moldings 4 inches or less in width.

COMPARISON WITH BASIC GRADES.

(61) Molding grades shall conform to the basic grades in D and better grades, except as noted:

Standard grades.	*Basic grades.*
(62) A Molding..	A grade.
(63) B Molding..	B grade, except that only one allowable defect or blemish is permitted. Knots shall be confined to pin knots.
(64) C Molding..	C and D grades combined.

SPECIAL PROVISIONS.

(65) Medium crook will be permitted in all grades.

FLOORING.

MATERIAL INCLUDED.

(66) Dressed and matched stock from $\frac{3}{8}$ to $1\frac{1}{2}$ inches thick and from 2 to 6 inches wide which is to be used for flooring shall be graded as Flooring.

(67) STANDARD SIZES.

THICKNESSES.

Nominal thickness.	Dressed thickness S1S or S2S.
Inches.	*Inches.*
$\frac{3}{8}$	$\frac{5}{16}$
$\frac{1}{2}$	$\frac{7}{16}$
$\frac{5}{8}$	$\frac{9}{16}$
$\frac{3}{4}$	$\frac{11}{16}$
1	$1\frac{3}{16}$
$1\frac{1}{4}$	$1\frac{7}{16}$
$1\frac{1}{2}$	$1\frac{9}{16}$

(67) **STANDARD SIZES**—Continued.

WIDTHS.

Nominal width.	Face width.	Width of tongue based on 1-inch lumber.	Over-all width based on 1-inch lumber.
Inches.	*Inches.*	*Inches.*	*Inches.*
2	$1\frac{1}{2}$	$\frac{1}{4}$	$1\frac{3}{4}$
3	$2\frac{1}{2}$	$\frac{1}{4}$	$2\frac{3}{4}$
4	$3\frac{1}{2}$	$\frac{1}{4}$	$3\frac{3}{4}$
5	$4\frac{1}{2}$	$\frac{1}{4}$	$4\frac{3}{4}$
6	$5\frac{1}{2}$	$\frac{1}{4}$	$5\frac{3}{4}$

LENGTHS.

Standard lengths shall be 4 to 20 feet in multiples of 1 foot.

STANDARD SHIPPING PRACTICES.

BUNDLING.

(68) Flooring shall be securely tied into bundles.

RANDOM LENGTHS.

(69) The following percentages of short lengths shall be allowed in random length shipments unless otherwise agreed upon:

A, B, and C Flooring.....	5 per cent 6 and 7 feet.
	5 per cent 8 and 9 feet.
No. 1 Common Flooring..	5 per cent 6 and 7 feet.
	10 per cent 8 and 9 feet.
No. 2 Common Flooring..	5 per cent 4 and 5 feet.
	5 per cent 6 and 7 feet.
	10 per cent 8 and 9 feet.
No. 3 Common Flooring..	Any amount 4 feet to 20 feet.

These percentages refer to the contents of a shipment in board feet.

GRAIN.

(70) Flooring may be manufactured either in vertical or flat grain. When vertical grain is specified, material shall show at least five annual rings of growth per inch across the face of the piece. It may also be graded as Heart Flooring, Heart-Face Flooring, or Sap Flooring.

Any of the above terms may be applied to any of the standard grades of flooring and shall indicate that, in addition to conforming to the restrictions as to defects and blemishes admitted in the grade, it must also meet the requirements as to grain or heartwood.

STANDARD GRADES.

(71) Grade names: A Flooring, B Flooring, C Flooring, No. 1 Common Flooring, No. 2 Common Flooring, and No. 3 Common Flooring.

BASIS OF GRADE.

(72) The basis of grade shall be a piece 1 by 4 inches by 16 feet, or $5\frac{1}{3}$ surface feet.

COMPARISON WITH BASIC GRADES.

(73) Flooring grades shall conform to the basic grades in No. 3 Common and better grades, except as noted:

Standard grades.	*Basic grades.*
(74) A Flooring	A grade.
(75) B Flooring	B grade, except that a medium pitch streak will be permitted. In 3-inch flooring the maximum knot shall be 1¼ inches.
(76) C Flooring	C grade.
(77) No. 1 Common Flooring	D grade and No. 1 Common combined.
(78) No. 2 Common Flooring	No. 2 and No. 3 Common, except that it must be suitable for use in cheap floors without waste of over 25 per cent of the length of a piece.
(79) No. 3 Common Flooring	Degraded flooring which will not come up to No. 2 Common Flooring, but which is suitable for lathing or sheathing purposes, will be admitted in this grade.

(80) SPECIAL PROVISIONS.

The *face* of a piece must be smoothly dressed, conform to the rules as regards grain, and be free from wane in No. 1 Common and better grades.

The *reverse side* of a piece must be of such a nature as not to cause waste in No. 1 Common and better grades.

The *tongue* in C and better grades shall extend the full length of the piece. In No. 1 Common the tongue may be broken out over a length of 6 inches. In either grade the tongue may be $\frac{1}{16}$ inch scant in width. Tongue down to $\frac{1}{16}$ inch wide may be admitted in No. 2 Common, but scantness to this extent shall be considered a serious defect. Wane may extend not over half the thickness of the tongue for a distance of one-fourth the length of a piece in No. 1 Common and better grades.

The *upper lip of the groove* must be full width and without wane in No. 1 Common and better grades. Wane extending completely through the *lower lip* will be permitted for a distance of 6 inches in B and better grades and 12 inches in C grade and No. 1 Common.

Slight mismatch will be admitted in any grade of flooring.

Medium mismatch will be admitted in No. 1 Common, provided it is otherwise as good as B grade.

Heavy mismatch, not more than $\frac{1}{16}$ inch, will be admitted in No. 2 Common. Material mismatched more than $\frac{1}{16}$ inch may be admitted in No. 2 Common, but it shall be considered waste at the point of mismatch.

Medium crook will be permitted in all grades of flooring, except A grade.

CEILING AND PARTITION.

MATERIAL INCLUDED.

(81) Material 3 to 6 inches wide, dressed, matched, and beaded or V'd one or two sides according to pattern for use as ceiling, wainscoting, partition, etc., shall be graded as Ceiling and Partition.

(82) **STANDARD SIZES.**

THICKNESSES.

Nominal thickness.	Dressed thickness S1S or S2S.
Inches.	*Inches.*
$\frac{3}{8}$	$\frac{5}{16}$
$\frac{1}{2}$	$\frac{7}{16}$
$\frac{5}{8}$	$\frac{9}{16}$
$\frac{3}{4}$	$\frac{11}{16}$
1	$\frac{3}{4}$

WIDTHS.

Nominal Width.	Face width.	Width of tongue based on 1-inch lumber.	Over-all width based on 1-inch lumber.
Inches.	*Inches.*	*Inches.*	*Inches.*
3	$2\frac{3}{8}$	$\frac{1}{4}$	$2\frac{5}{8}$
4	$3\frac{3}{8}$	$\frac{1}{4}$	$3\frac{5}{8}$
5	$4\frac{3}{4}$	$\frac{1}{4}$	$4\frac{1}{2}$
6	$5\frac{3}{4}$	$\frac{1}{4}$	$5\frac{1}{2}$

LENGTHS.

Standard lengths shall be 4 to 20 feet in multiples of 1 foot.

STANDARD SHIPPING PRACTICES.

BUNDLING.

(83) Ceiling and Partition shall be securely tied into bundles.

RANDOM LENGTHS.

(84) The following percentages of short lengths shall be allowed in random length shipments unless otherwise agreed upon:

A, B, and C Ceiling or Partition.....	5 per cent 6 and 7 feet.
	5 per cent 8 and 9 feet.
No. 1 Common Ceiling or Partition..	5 per cent 6 and 7 feet.
	10 per cent 8 and 9 feet.
No. 2 Common Ceiling or Partition..	5 per cent 4 and 5 feet.
	5 per cent 6 and 7 feet.
	10 per cent 8 and 9 feet.

These percentages refer to the contents of a shipment in board feet.

GRAIN.

(85) Ceiling and Partition may be manufactured either in vertical or flat grain. It may also be graded as Heart, Heart Face, or Sap Ceiling or Partition.

STANDARD GRADES.

(86) Grade names: *Ceiling*—A Ceiling, B Ceiling, C Ceiling, No. 1 Common Ceiling, and No. 2 Common Ceiling. *Partition*—A Partition, B Partition, C Partition, No. 1 Common Partition, and No. 2 Common Partition.

BASIS OF GRADE.

(87) The basis of grade shall be a piece 1 by 4 inches by 16 feet, or $5\frac{1}{3}$ surface feet.

COMPARISON WITH BASIC GRADES.

(88) Ceiling and Partition grades shall conform to the basic grades in No. 3 Common and better grades, except as noted.

Standard grades.	*Basic grades.*
(89) A Ceiling and Partition	A grade.
(90) B Ceiling and Partition	B grade, except that a medium pitch streak will be permitted.
(91) C Ceiling and Partition	C grade.
(92) No. 1 Common Ceiling and Partition	D grade and No. 1 Common.
(93) No. 2 Common Ceiling and Partition	No. 2 and No. 3 Common combined, except that each piece must lay without waste of over 25 per cent of its length.

(94) SPECIAL PROVISIONS.

The *face* of a piece must be smoothly dressed, conform to the rules as regards grain, and be free from wane in No. 1 Common and better grades.

The *reverse side* of a piece of ceiling must be of such a nature as not to cause waste in No. 1 Common and better grades. The reverse side of partition shall not be more than one grade below the face. Wane shall not be allowed on the reverse side of partition in C and better grades.

The *tongue* in C and better grades shall extend the full length of the piece. In No. 1 Common, the tongue may be broken out over a length of 6 inches. In either grade the tongue may be $\frac{1}{16}$ inch scant in width. Tongue down to $\frac{1}{16}$ inch wide may be admitted in No. 2 Common, but scantness to this extent shall be considered a serious defect. Wane may extend not over half the thickness of the tongue for a distance of one-third the length of a piece in No. 1 Common and better grades.

The *upper lip of the groove* must be full width and without wane in No. 1 Common and better grades. Wane extending completely through the *lower lip* will be permitted for a length of 9 inches in B and better grades and 18 inches in C grade and No. 1 Common.

Medium mismatch will be admitted in any grade of Ceiling and Partition.

Heavy mismatch, not more than $\frac{1}{16}$ inch, will be admitted in No. 2 Common. Material mismatched more than $\frac{1}{16}$ inch may be admitted in No. 2 Common, but it shall be considered waste at the point of mismatch.

Medium crook will be permitted in all grades of Ceiling and Partition, except A grade.

SIDING.

MATERIAL INCLUDED.

(95) Material 1 inch thick or less, 4 to 10 inches wide, worked according to pattern or bevel-sawed for use as siding shall be graded as Siding. There shall be three classes, as determined by the patterns and widths.

1. Drop or Novelty Siding..... 4 to 10 inches wide.
2. Bevel Siding:
   (a) Plain..... 4 to 6 inches wide.
   (b) Bungalow or Colonial.. 8 to 12 inches wide.
3. Rustic Siding..... 6 to 10 inches wide.

STANDARD SIZES.

(96) Rustic and Drop Siding.

THICKNESSES.

Nominal thickness.	Dressed thickness.
Inches.	*Inches.*
$\frac{5}{8}$	$\frac{9}{16}$
1	$\frac{3}{4}$

WIDTHS.

Nominal width.	Face width.	
	D & M.	Ship-lapped.
Inches.	*Inches.*	*Inches.*
4	$3\frac{1}{4}$	.....
5	$4\frac{1}{4}$	.....
6	$5\frac{1}{4}$	$5\frac{1}{8}$
8	$7\frac{1}{4}$	$7\frac{1}{8}$
10	.....	$9\frac{1}{8}$

Based on lumber 1 inch thick, the width of the tongue in dressed and matched shall be $\frac{1}{4}$ inch, and the width of the rabbet in shiplapped siding shall be $\frac{3}{8}$ inch.

(97) Bevel Siding (Plain, Bungalow, and Colonial).

THICKNESSES.

Nominal thickness.	Dressed thickness.
Inches.	*Inches.*
$\frac{1}{2}$ by $\frac{1}{4}$	$\frac{1}{2}$ by $\frac{3}{16}$
$\frac{5}{8}$ by $\frac{1}{4}$	$\frac{5}{8}$ by $\frac{3}{16}$

WIDTHS.

Nominal width.	Dressed width.
Inches.	*Inches.*
4	$3\frac{1}{2}$
5	$4\frac{1}{2}$
6	$5\frac{1}{2}$
8	$7\frac{1}{2}$
10	$9\frac{1}{2}$
12	$11\frac{1}{2}$

LENGTHS.

Standard lengths for Drop, Bevel, and Rustic Siding shall be 3 to 20 feet in multiples of 1 foot.

STANDARD SHIPPING PRACTICES.

BUNDLING.

(98) Siding in widths up to 6 inches shall be securely tied into bundles. Siding wider than 6 inches may be shipped either bundled or loose, at the option of the shipper.

RANDOM LENGTHS.

(99) The following percentages of short lengths shall be allowed in random-length shipments unless otherwise agreed upon:

A, B, and C Siding.....	5 per cent 6 and 7 feet.
	5 per cent 8 and 9 feet.
No. 1 Common Siding.....	5 per cent 6 and 7 feet.
	10 per cent 8 and 9 feet.
No. 2 Common Siding.....	5 per cent 3, 4, and 5 feet.
	5 per cent 6 and 7 feet.
	10 per cent 8 and 9 feet.
No. 3 Common Siding.....	Any amount 3 to 20 feet.

These percentages refer to the contents of a shipment in board feet.

STANDARD GRADE FOR ALL SIDINGS.

(100) Grade names: A Siding, B Siding, C Siding, No. 1 Common Siding, No. 2 Common Siding, and No. 3 Common Siding.

BASIS OF GRADE.

(101) The basis of grade shall be a piece 12 feet long by the width being graded.

COMPARISON WITH BASIC GRADES.

(102) Siding grades shall conform to the basic grades in No. 3 Common and better grades, except as noted:

	Standard grades.	*Basic grades.*
(103)	A Siding.....	A grade, except that slight torn grain will be permitted.
(104)	B Siding.....	B grade, except that medium torn grain and double the amount of medium discoloration or firm red heart and slight skip will be permitted.
(105)	C Siding.....	C grade, except that pitch shall be limited to two medium pitch streaks in any piece. Pieces containing a knot hole or equivalent defect which may be removed with a waste of not to exceed 3 inches in length may be permitted, provided the piece is otherwise of B or better quality.
(106)	No. 1 Common Siding..	D grade and No. 1 Common combined.
(107)	No. 2 Common Siding..	No. 2 and No. 3 Common combined, except that it must lay without waste of more than 25 per cent of the length of a piece.
(108)	No. 3 Common Siding...	Degraded siding which will not come up to No. 2 Common Siding, but which is suitable for cheap lining or lathing, will be admitted in this grade.

(109) SPECIAL PROVISIONS.

The *face* of a piece must be smoothly dressed, conform to the rules as regards grain, and be free from wane on the face side in No. 1 Common and better grades, except as the equivalent of admissible torn grain.

The *reverse side* of a piece must be of such a nature as not to cause waste in No. 1 Common and better grades.

Defects such as loose knots or knot holes on the thin or covered edge of siding which will be covered when laid will not influence the grades of siding.

The *tongue* in matched patterns and the *covered edge* in lapped patterns in C and better grades shall extend the full length of the piece. In any grades the tongue or the covered edge may be $\frac{1}{16}$ inch scant in width. Tongue or covered edge down to $\frac{1}{16}$ inch wide may be admitted in No. 2 Common, but such scantness shall be considered a serious defect. Wane may extend not over half the thickness of the tongue or covered edge for a distance of one-third the length of a piece in No. 1 Common and better grades.

The *upper lip of the groove* in matched patterns or the *lap* in lapped patterns must be full width and without wane in No. 1 Common and better grades. Wane extending completely through the lower lip in matched patterns will be permitted for a distance of 6 inches in B and better grades and 12 inches in C grades and No. 1 Common.

Medium mismatch will be admitted in any grade of worked siding.

Heavy mismatch not more than $\frac{1}{16}$ inch, will be admitted in No. 2 Common. Material mismatched more than $\frac{1}{8}$ inch may be admitted in No. 2 Common, but it shall be considered waste at the point of mismatch.

Small crook will be permitted in all grades of bevel siding, except A grade.

Medium crook will be permitted in all grades of worked siding, except A grade.

COMMON BOARDS.

MATERIAL INCLUDED.

(110) Lumber from 1 to 2 inches thick and from 3 to 12 inches wide, containing knots and other defects in varying degrees, which is to be used where appearance is of minor or no importance, shall be graded as Common Boards. There shall be three classes as determined by the patterns:

1. Common Boards—rough or dressed one, two, three, or four sides.
   (a) Strips or Fencing—Common Boards 3 to 6 inches wide.
2. Ship-lap—Common Boards worked Ship-lap.
3. Dressed and Matched (D&M)—Common Boards dressed, tongued, and grooved.

(111) STANDARD SIZES.

Common Boards, dressed one, two, or four sides.

THICKNESSES.

Nominal thickness.	Dressed thickness S1S or S2S.
Inches.	*Inches.*
1	$\frac{13}{16}$
$1\frac{1}{4}$	$1\frac{1}{16}$
$1\frac{1}{2}$	$1\frac{5}{16}$
2	$1\frac{5}{8}$

WIDTHS.

Standard widths shall be multiples of 1 inch.

Nominal width.	Dressed width S1E or S2E.
Inches.	*Inches.*
3	$2\frac{5}{8}$
4	$3\frac{5}{8}$
5	$4\frac{5}{8}$
6	$5\frac{5}{8}$
7	$6\frac{5}{8}$
8	$7\frac{1}{2}$
9	$8\frac{1}{2}$
10	$9\frac{1}{2}$
11	$10\frac{1}{2}$
12	$11\frac{1}{2}$

(112) SHIP-LAP.

THICKNESSES.

Nominal thickness.	Dressed thickness S1S or S2S.
Inches.	*Inches.*
1	$\frac{13}{16}$
2	$1\frac{5}{8}$

WIDTHS.

Standard widths shall be multiples of 2 inches.

Nominal width.	Face width.	Rabbet based on 1-inch lumber	Over-all based on 1-inch lumber.
Inches.	*Inches.*	*Inches.*	*Inches.*
4	$3\frac{1}{8}$	$\frac{3}{8}$	$3\frac{1}{2}$
6	$5\frac{1}{8}$	$\frac{3}{8}$	$5\frac{1}{2}$
8	$7\frac{1}{8}$	$\frac{3}{8}$	$7\frac{1}{2}$
10	$9\frac{1}{8}$	$\frac{3}{8}$	$9\frac{1}{2}$
12	$11\frac{1}{8}$	$\frac{3}{8}$	$11\frac{1}{2}$

In 2-inch thickness the rabbet shall be $\frac{1}{2}$ inch and the face width $\frac{1}{8}$ inch less than shown.

(113) DRESSED AND MATCHED.

THICKNESSES.

Nominal thickness.	Dressed thickness. S1S or S2S.
Inches.	*Inches.*
1	$\frac{3}{4}$
$1\frac{1}{4}$	$1\frac{1}{16}$
$1\frac{1}{2}$	$1\frac{5}{16}$
2	$1\frac{5}{8}$

WIDTHS.

Standard widths shall be in multiples of 2 inches.

Nominal width.	Face width.	Width of tongue based on 1-inch lumber.	Over-all width based on 1-inch lumber.
Inches.	*Inches.*	*Inches.*	*Inches.*
4	$3\frac{1}{4}$	$\frac{1}{4}$	$3\frac{1}{2}$
6	$5\frac{1}{4}$	$\frac{1}{4}$	$5\frac{1}{2}$
8	$7\frac{1}{4}$	$\frac{1}{4}$	$7\frac{1}{2}$
10	$9\frac{1}{4}$	$\frac{1}{4}$	$9\frac{1}{2}$
12	$11\frac{1}{4}$	$\frac{1}{4}$	$11\frac{1}{2}$

In 2-inch thickness the tongue shall be $\frac{3}{8}$ inch and the face width $\frac{1}{8}$ inch less than shown.

LENGTHS.

(114) Standard lengths for Common Boards (rough or dressed, worked Ship-lap, or dressed and matched) shall be 4 to 24 feet in multiples of 1 foot.

STANDARD SHIPPING PRACTICES.

RANDOM LENGTHS.

(115) The following percentages of short lengths shall be allowed in random length shipments unless otherwise agreed upon:

No. 2 Common and better grades..	5 per cent 6 and 7 feet.
	5 per cent 8 and 9 feet.
Nos. 3 and 4 Common.....	5 per cent 4 and 5 feet.
	5 per cent 6 and 7 feet.
	10 per cent 8 and 9 feet.
No. 5 Common.....	Any amount 4 to 24 feet.

These percentages refer to the contents of a shipment in board feet.

STANDARD GRADES FOR COMMON BOARDS (ROUGH OR DRESSED, WORKED SHIP-LAP, OR DRESSED AND MATCHED).

(116) Grade names: Select Common, No. 1 Common, No. 2 Common, No. 3 Common, No. 4 Common, and No. 5 Common.

BASIS OF GRADES.

(117) The basis of grade shall be a piece 1 by 8 inches by 12 feet, or 8 surface feet.

COMPARISON WITH BASIC GRADES.

(118) Common Board grades shall conform to the basic grades in the grades ranging from No. 5 Common to D grade, inclusive, except as noted:

Standard grades.	*Basic grades.*
(119) Select Common..	D grade, except that the only pieces admitted in this grade must be selected with special reference to Select Common quality rather than finishing appearance. The reverse side of a piece should not be more than one grade lower than the face side.
(120) No. 1 Common...	No. 1 Common.
(121) No. 2 Common...	No. 2 Common.
(122) No. 3 Common...	No. 3 Common.
(123) No. 4 Common...	No. 4 Common.
(124) No. 5 Common...	No. 5 Common.

(125) SPECIAL PROVISIONS.

Tongue not less than $\frac{3}{16}$ inch wide may be admitted in No. 1 Common and better grades of Dressed and Matched, $\frac{1}{8}$ inch in Nos. 2 and 3 Common, and $\frac{1}{16}$ inch in the lower grades, but the allowable scantness of the tongue shall be considered a serious defect and must not be permitted in combination with other serious defects. In the grades of Select and No. 1 Common the tongue may be broken out over a length of 6 inches.

The *upper lip of the groove* in No. 2 Common and better grades of Dressed and Matched must be full width. Lack of groove shall be considered wane and will be considered as occasioning waste.

Heavy mismatch in worked patterns, not more than $\frac{1}{16}$ inch, may be admitted in No. 2 Common and better grades, but it shall be considered a serious defect and will not be permitted in combination with other serious defects.

Either *lap* not less than $\frac{5}{16}$ inch may be admitted in No. 1 Common and better grades of Ship-lap, $\frac{3}{16}$ inch in Nos. 2 and 3 Common, and $\frac{1}{16}$ inch in the lower grades, but the allowable scantness of the lap shall be treated as a serious defect and must not be permitted in combination with other serious defects.

Defects such as wane, knot holes, and wormholes on the covered lap of Ship-lap which will be covered when laid will be permitted in any grade. They must not be so serious as to occasion waste in No. 2 Common and better grades.

DIMENSION.

MATERIAL INCLUDED.

(126) Lumber manufactured at the sawmill in standard sizes for use where strength, stiffness, and uniformity of size are essential shall be graded as Dimension. It is usually 2 inches in thickness, occasionally thicker, and 2 inches and up in width.

(127) STANDARD SIZES.

THICKNESSES.

Nominal thickness.	Dressed thickness S1S or S2S.
Inches.	*Inches.*
2	$1\frac{5}{8}$
$2\frac{1}{2}$	$2\frac{1}{8}$
3	$2\frac{5}{8}$
4	$3\frac{5}{8}$
Over 4	$\frac{3}{8}$ scant.

WIDTHS.

Nominal width.	Dressed width S1E or S2E.
Inches.	*Inches.*
2	$1\frac{5}{8}$
4	$3\frac{5}{8}$
6	$5\frac{5}{8}$
8	$7\frac{1}{2}$
10	$9\frac{1}{2}$
12	$11\frac{1}{2}$
Over 12	$\frac{1}{2}$ scant.

LENGTHS.

Standard lengths shall be 4 to 24 feet in multiples of 1 foot.

STANDARD SHIPPING PRACTICES.

RANDOM LENGTHS.

(128) The following percentages of short lengths shall be allowed in random length shipments unless otherwise agreed upon:

Select and No. 1 Common Dimension	5 per cent 8 and 9 feet.
No. 2 Common Dimension	5 per cent 6 and 7 feet.
	5 per cent 8 and 9 feet.
No. 3 Common Dimension	Any amount 4 to 24 feet.

These percentages refer to the contents of a shipment in board feet.

STANDARD GRADES.

(129) Grade names: Select Common Dimension, No. 1 Common Dimension, No. 2 Common Dimension, and No. 3 Common Dimension.

BASIS OF GRADE.

(130) In the grading of Dimension, strength, stiffness, and uniformity of size are important, with appearance as a secondary consideration in the higher grades. Defects, therefore, will be admitted in various grades primarily in accordance with their effect upon the strength of the piece.

COMPARISON WITH BASIC GRADES.

(131) Dimension grades shall conform to the basic grades in the grades ranging from No. 5 Common to D grade inclusive, except as noted:

Standard grades.	*Basic grades.*
(132) Select Common Dimension	D grade, except that the only pieces admitted in this grade shall be selected with special reference to strength, stiffness, and uniformity of size, rather than finishing appearance. Pieces containing a cutting defect will not be permitted. Slight cross grain will be permitted.
(133) No. 1 Common Dimension	No. 1 Common, except that the following defects will be permitted: Sound intergrown and tight encased knots and pith knots on or near the edges as follows: 1½ inches in diameter in 4-inch and 6-inch widths, 2 inches in 8-inch and 10-inch, 2½ inches in 12-inch, and not over 3 inches in wider widths. Knots toward the center of a piece are less serious than those located on or near the edge and may be larger but not to exceed one and one-half times the maximum size knot permitted on the edges. Unsound, loose, and hollow knots one-half the diameter of the maximum size of sound knots. Wane—Equivalent to ¾ inch deep on the edge, one-fourth the width, and one-third the length of the piece. Grub wormholes—Three per surface foot. Miscut material which is not more than ⅛ inch scant of the standard dressed size may be permitted, provided the piece shall be free from other defects at the point of miscut.

Standard grades.	*Basic grades.*
(134) No. 2 Common Dimension...	No. 2 Common, except that each piece shall be suitable for use as a whole for the cheaper class of construction. Each piece must present a nailing surface on the edge its full length. The following defects, however, will be permitted. Sound or unsound tight knots on or near the edges as follows: 2 inches in diameter in 4-inch widths, 2½ inches in 6-inch, 3 inches in 8-inch, 3½ inches in 10-inch, and 4 inches in 12-inch and wider. Knots toward the center of a piece are less serious than those located on or near the edge and in widths 6 inches wide and wider may be larger but not to exceed one and one-half times the maximum size knot permitted on the edges. Loose or decayed knots or knot holes one-half the diameter of the maximum size sound knots permitted. Wane—Equivalent to 1 inch deep on the edge by one-third the width of the piece. Medium crook not to exceed 2 inches. Grub wormholes—Six per surface foot. Miscut material, which is not more than ¼ inch scant of the standard dressed size may be permitted, provided the piece is of No. 1 Common quality at the point of miscut. No pieces permitting waste will be admitted.
(135) No. 3 Common Dimension...	No. 3 Common, except that each piece shall be suitable as a whole for use for very cheap or temporary construction or shall cut not less than 75 per cent of material of No. 2 Common quality. No restrictions on the size or number of cuttings.

FACTORY FLOORING, HEAVY ROOFING, DECKING, AND SHEET PILING.

MATERIAL INCLUDED.

(136) Lumber 2 to 6 inches thick, 4 to 12 inches wide, dressed one or two sides, and tongued and grooved, ship-lapped, or plowed for splines for use as factory flooring, heavy roofing, decking, or sheet piling, shall be graded as Factory Flooring, Heavy Roofing, Decking, or Sheet Piling.

(137) STANDARD SIZES.

THICKNESSES.

Nominal thickness.	Dressed thickness S1S or S2S.
Inches.	*Inches.*
2	1⅝
2½	2⅛
3	2⅝
4	3⅝

(137) STANDARD SIZES—Continued.

WIDTHS.

Nominal width.	Face width.		
	D&M	Shiplapped.	Plowed for splines.
Inches.	*Inches.*	*Inches.*	*Inches.*
4	$3\frac{1}{8}$	.....	.....
6	$5\frac{1}{8}$	5	$5\frac{1}{2}$
8	$7\frac{1}{8}$	7	$7\frac{1}{2}$
10	.....	9	$9\frac{1}{2}$
12	.....	11	$11\frac{1}{2}$

Based on lumber 2 inches thick, the width of the tongue in dressed and matched shall be $\frac{3}{8}$ inch, and the width of the rabbet in shiplapped material shall be $\frac{1}{2}$ inch.

LENGTHS.

Standard lengths shall be 6 to 24 feet in multiples of 1 foot.

STANDARD SHIPPING PRACTICES.

RANDOM LENGTHS.

(138) The following percentages of short lengths shall be allowed in shipments permitting short lengths:

Select and No. 1 Common.. 5 per cent 8 and 9 feet.
No. 2 Common..... 5 per cent 6 and 7 feet.
5 per cent 8 and 9 feet.

STANDARD GRADES FOR FACTORY FLOORING, HEAVY ROOFING, DECKING, AND SHEET PILING.

(139) Grade names: Select Common Factory Flooring, Heavy Roofing, Decking, or Sheet Piling. No. 1 Common Factory Flooring, Heavy Roofing, Decking, or Sheet Piling. No. 2 Common Factory Flooring, Heavy Roofing, Decking, or Sheet Piling.

BASIS OF GRADE.

(140) The grading of Factory Flooring, Heavy Roofing, Decking, and Sheet Piling is a matter of strength, stiffness, and uniformity of size. Defects, therefore, will be admitted in various grades primarily in accordance with their effect upon the strength of the piece.

COMPARISON WITH BASIC GRADES.

(141) Factory Flooring, Heavy Roofing, Decking, and Sheet Piling grades shall conform to the basic grades in the grades ranging from No. 2 Common to D grade, inclusive, except as noted:

Standard grades.	*Basic grades.*
(142) Select Common..	D grade, except that the only pieces admitted in this grade must be selected with special reference to select common quality rather than finish appearance. The reverse side of a piece should not be more than one grade lower than the face side. Pieces containing a cutting defect will not be permitted.

Standard grades.	*Basic grades.*
(143) No. 1 Common...	No. 1 Common, except that no knots larger than those described are permissible on the edge, but knots toward the center of a piece are less serious than those located on or near the edge and may be larger, but not to exceed one and one-half times the maximum size knot permitted on the edge.
(144) No. 2 Common...	No. 2 Common, except that no knots larger than those described are permissible on the edge, but knots toward the center of a piece are less serious than those located on or near the edge and may be larger, but not to exceed one and one-half times the maximum size knot permitted on the edge. Unsound knots will be considered as causing waste and will be permitted in 25 per cent of the pieces only.

(145) SPECIAL PROVISIONS.

The *face* of a piece must be free from wane in No. 1 Common and better grades.

Tongue in Dressed and Matched and either *lap* in Ship-lap $\frac{1}{16}$ inch scant will be permitted in No. 1 Common and better grades. Tongue or lap not less than $\frac{1}{8}$ inch may be permitted in No. 2 Common, but not in combination with other serious defects. Wane extending one-half the thickness of the tongue, completely through the lower lip of the groove in Dressed and Matched and material plowed for splines, and completely through the covered lap of Ship-lap, will be permitted in No. 1 Common over a length of 12 inches.

SUGGESTED SHIPPING INSTRUCTIONS.

SIZES.

(146) The following nominal thicknesses, widths, and lengths shall be considered standard. All other sizes shall be considered as special.

Thicknesses: $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$, 2, $2\frac{1}{2}$, and 3 inches and up in multiples of 1 inch.

Widths: 1 inch and up in multiples of 1 inch. Finish and Common boards, either rough or surfaced one or two sides, may be shipped on actual width when agreed upon.

Lengths: 1 foot and up in multiples of 1 foot. When agreed upon, lengths not exactly on the foot lengths shall be permissible, but each piece will be counted as of the nearest foot length.

(147) The sizes specified for all products shall be based on lumber properly seasoned for its intended use. For products ordinarily air dried this moisture content shall be considered 15 per cent; for products which are ordinarily kiln dried, it shall be considered 8 per cent.

(148) Lumber shipped rough must be of such size that when dry it will dress to the sizes prescribed as standard for lumber dressed two or four sides.

(149) In shipments of rough boards or dimension pieces $\frac{1}{2}$ inch or more above the count thickness, such as may be produced by uneven sawing, may, at the option of the buyer, be rejected or accepted and paid for at the market price for the next lower grade.

(150) Unless otherwise specifically agreed upon, the proportion of short lengths allowed in the various grades shall be included in all shipments.

(151) Shipments of mixed widths and/or mixed lengths shall contain a fair assortment of each width or each length.

(152) Shipments of random widths and/or lengths when the average size is not specified shall contain an average width and/or length representing the average of the range of sizes specified.

(153) The average length of a shipment of lumber shall be computed by dividing the total length in feet by the total number of pieces in a shipment.

(154) The average width of a shipment of lumber 1 inch or less in thickness shall be computed by dividing the total board feet by the total length in feet and multiplying the result by 12. The total board-foot tally of lumber thicker than 1 inch shall be divided first by the thickness as expressed in inches and fractions of an inch.

MEASUREMENT AND TALLY.

(155) Lumber shall be tallied surface or face measure, and this tally shall be the number of feet, board measure, of 1-inch lumber. All lumber less than 1 inch shall be counted surface measure. The tally of lumber thicker than 1 inch shall be multiplied by the thickness as expressed in inches and fractions of an inch.

(156) Material shipped on stock sizes shall be tallied by the number of pieces of each size and length.

(157) In shipments measured with a board rule, a piece tally in feet shall be made.

(158) In material measured with a board rule on actual widths, pieces measuring to the even half foot shall be alternately counted as of the next higher and lower foot count; fractions below the one-half foot shall be dropped and fractions above the one-half shall be counted as of the next higher foot.

(159) Unedged lumber shall be measured across the average width of the board on the narrow face in 1-inch, 1¼-inch, and 1½-inch lumber. The width of 2-inch and thicker material shall be one-half of the sum of the average widths of the narrow and wide faces.

(160) Small dimension stock shall be tallied by the exact board feet contents.

(161) All dressed stock shall be measured and sold on the basis of the nominal size of the rough material necessarily used in its manufacture.

GRADES.

(162) Lumber must be accepted on grade in the form in which it was shipped. Any subsequent change in manufacture or millwork will prohibit an inspection for the adjustment of claims, except with the consent of all parties interested.

(163) All lumber is graded with special reference to its suitability for the use intended. With this in view, each piece is considered and its grade determined by its general character, including the location and sum of all its defects and blemishes.

(164) The grading of lumber can not be considered an exact science, because it is based on a visual inspection of each piece and on the judgment of the grader. The provisions of these specifications, however, are sufficiently explicit to establish 5 per cent below grade as a reasonable departure from a grade.

(165) When special sizes or patterns of lumber are ordered, unless a special agreement is made, it shall be permissible to ship all of the lower grades that develop in their manufacture, provided this does not exceed 15 per cent of the quantity ordered and provided that this degrade be paid for at the usual differential in price between these grades.

(166) Vertical-grain (edge-grain, rift-grain, comb-grain, or quarter-sawed) material is that which has been sawed at approximately right angles to the annual layers or rings of growth. Material shall be considered vertical grain when the rings (so-called grain) form an angle of 45° or more with the surface of the piece. When the angle becomes less than 45° at any point, the material shall be known as flat (slash) grain.

(167) Heart-face material is that which shows all heartwood on the face.

(168) All heart material is that which is all heartwood.

(169) Material ordered under a heartwood specification, other than heart face or all heart, shall state the amount or percentage of heartwood desired and how it shall be measured.

(170) Material shipped under the heartwood, sapwood, or grain clauses shall conform to the specifications for such material in addition to restrictions as to defects and blemishes.

(171) Material selected for grain or heartwood should have the grade mark preceded by a special mark, such as V for vertical, F for flat, H for all heart, HF for heart face, and S for sapwood.

SEASONING.

(172) *Shipping dry lumber* (*Sh. D.*).—Lumber partially dried in order to reduce freight and to permit of close piling during the ordinary shipping period in warm weather without deterioration from stain and decay shall be considered shipping-dry.

(173) *Seasoned lumber* (*Sd.*).—Lumber dried to a proper moisture content for the intended use shall be considered seasoned. For yard lumber this shall not exceed 18 per cent.

(174) *Air-dry lumber* (*AD.*).—Lumber seasoned without artificial heat shall be considered air-dry. Except in very dry regions, its moisture content is seldom less than 12 per cent.

(175) *Kiln-dried lumber* (*KD*).—Lumber seasoned with the aid of artificial heat shall be considered kiln-dry. It shall contain between 6 and 10 per cent moisture, unless otherwise specified. In ordering kiln-dried lumber it is preferable that the permissible upper and lower moisture limits be stated.

BUNDLING.

(176) Products such as flooring, ceiling, partition, casing and base, and siding shall be securely tied into bundles. The face side of each of the two outside pieces shall be turned in.

DEFINITIONS OF DEFECTS AND BLEMISHES.

(177) The following definitions of defects and blemishes are recommended for standard use and are used in these specifications.

(178) A *defect* is any irregularity occurring in or on wood that may lower some of its strength values.

(179) A *blemish* is anything, not classified as a defect, marring the appearance of the wood.

(180) The commonly recognized defects and blemishes occurring in yard lumber are:

Bark pockets.	Decay.	Pitch pockets.
Bird pecks.	Discolorations.	Pitch seams.
Bird's-eye.	Gum spots and streaks.	Pith and pith flecks.
Checks.	Holes.	Shakes.
Collapse.	Imperfect manufacture.	Splits.
Compression failures.	Knots.	Wane.
Cross breaks.	Pitch.	Warping.
Cross grain.	Pitch streaks.	

BARK POCKETS.

(181) A *bark pocket* (Pl. III) is a patch of bark partially or wholly inclosed in the wood.

BIRD PECKS.

(182) A *bird peck* (Pl. III) is a small hole or patch of distorted grain resulting from birds pecking through the growing cells in the tree. It usually resembles in shape a carpet tack with the point toward the bark, and it is ordinarily accompanied by a discoloration extending along the grain and to a smaller extent around the layers of growth. A section through the discoloration produced by the bird peck produces what is commonly known as a *mineral streak*.

BIRD'S-EYE.

(183) *"Bird's-eye"* is an irregularity found in the wood of some species. It consists of a small central spot with the wood fibers arranged about it in the form of an ellipse, so as to give the appearance of an eye. As ordinarily found, "bird's-eye" is not a defect and may even give the wood in which it is found added value. However, when the center of the whorl is hollow and there are a large number present, "bird's-eye" must be considered a blemish in the same manner as chipped grain and the grade influenced accordingly.

CHECKS.

(184) A *check* (Pl. IV) is a lengthwise separation of the wood, the greater part of which occurs across the growth rings.

A *surface check* is a check occurring on the surface of a piece.

A *small surface check* is a perceptible opening not over 4 inches long.

A *medium surface check* (Pl. IV, fig. 1) is one not over $\frac{1}{32}$ inch wide, and over 4 but not more than 10 inches long.

A *large surface check* (Pl. IV, fig. 2) is one over $\frac{1}{32}$ inch wide and over 10 inches long.

An *end check* (Pl. IV, fig. 4) is one occurring on an end of a piece.

A *through check* (Pl. IV, fig. 4) is one extending from one surface through the piece to the opposite face or to an adjoining face.

A *heart check* is one starting at the pith and extending toward but not to the surface of a piece. Several of these occurring together are often called a *star check*.

Honeycombing (Pl. IV, fig. 3) is checking occurring in the interior of a piece; often the checks are not visible on the surface. On a cross section they usually appear as slits, or as open pockets whose width may appear very large in proportion to the radial length.

COLLAPSE.

(185) *Collapse* (Pl. V, fig. 1) is a caving in of the surfaces of a piece. It sometimes occurs in streaks, giving the surface a corrugated appearance and often is due to the flattening of the cells when wet wood is dried at high temperatures.

COMPRESSION FAILURES.

(186) A *compression failure* (Pl. V, fig. 2) is a wrinkling or buckling of the wood cells extending in a more or less irregular plane across the grain, such as is due to longitudinal crushing or compression.

CROSS BREAKS.

(187) A *cross break* (Pl. V, fig. 3) is a separation of the wood cells across the grain, such as may be due to tension resulting from unequal shrinkage or mechanical stresses.

CROSS GRAIN.

(188) *Cross-grained* wood is that in which the wood cells or fibers do not run parallel with the axis, or sides, of a piece.

Slight cross grain is a slope of the grain not over 1 inch in a length of 15 inches.
Medium cross grain is a slope of the grain over 1 inch in a length of 15 inches but not more than 1 inch in a length of 10 inches.
Heavy cross grain is a slope of the grain over 1 inch in a length of 10 inches.

Cross grain may be classified as spiral, diagonal, wavy, dip, curly, and interlocked grain. Forms of cross grain other than spiral and diagonal are not considered in excess of slight cross grain unless the deflection of the grain is continuous in one direction over a distance relatively long in proportion to the thickness or width of the piece.

Spiral-grained wood (Pl. VI) is that in which the fibers take a more or less winding or spiral course, as in a twisted tree. It may be detected on the flat-grain surface.
Diagonal-grained wood (Pl. VI) is that in which the fibers extend at an angle (i. e., diagonally) across a piece as a result of sawing at an angle across the annual layers of growth. It may appear on either the radial or flat-grain surface.
Wavy-grained wood (Pl. VII, figs. 2 and 3) is that in which the fibers collectively take the form of waves or undulations as indicated by the wavy surface of a split piece. It may appear on either the radial or flat-grain surface.
Dip-grained wood is that which has one wave or undulation of the fibers, such as occurs around knots and pitch pockets.
Curly grained wood is that in which the fibers are distorted so that they take a curled direction, as in "bird's-eye wood." These patches may vary up to several inches in diameter.
Interlocked-grained wood (Pl. VII, fig. 1) is that in which the grain slopes in one direction in a number of growth rings, then gradually reverses and slopes in an opposite direction in succeeding growth rings, then later reverses, etc.

DECAY.

(189) *Decay* (Pl. VIII) is disintegration of the wood substance due to the action of wood-destroying fungi. The words dote and rot mean the same as decay.

Incipient decay (Pl. VIII) is the early stage of decay in which the disintegration processes have not proceeded far enough to soften or otherwise change the hardness of the wood perceptibly. It is

usually accompanied by a slight discoloration or bleaching of the wood. Examples: Firm red heart in softwoods; "water-soak" stage of certain types of decay.

Firm red heart (Pl. VIII) is a stage of incipient decay characterized by a reddish color produced in the heart wood, which does not unfit the wood for the majority of yard purposes. It is caused by the fungus *Trametes pini* and occurs chiefly in the pines.

Water stain (*or soak*) is a term applied to a generally water-soaked area in heartwood, which is usually interpreted as the incipient stage of certain wood rots. It occurs in hemlock and possibly other woods.

Advanced (*or typical*) *decay* (Pls. VIII and IX) is the older stage of decay in which the disintegration process is readily recognized because the wood has become punky, soft and spongy, stringy, ring-shaked, pitted, or crumbly. Decided discoloration or bleaching of the rotted wood is often apparent. Examples: Brown and white rots; pocket rots.

A *brown rot* (Pl. IX) is a typical decay which is yellowish brown to brownish red in color. The wood is crumbly and usually breaks up into cubes.

A *white rot* (Pl. VIII) is a typical decay which is yellowish to white in color. It often occurs in irregular scattered areas. Frequently these areas have black lines at their margins.

A *pocket rot* (Pl. IX) is a typical decay, either white or brown, which appears in the form of a small, medium, or large hole or pocket or soft-rot area, usually surrounded by apparently sound wood.

A *small pocket rot* (Pl. VIII) is a pocket or soft rot area not ove $\frac{1}{16}$ inch wide by $\frac{1}{4}$ inch long. Example: A common stage of advanced (or typical) decay caused by the fungus *Trametes pini*. (Sometimes called *fleck rot*.)

A *medium pocket rot* (Pl. IX) is a pocket or soft-rot area over $\frac{1}{16}$ inch but not more than $\frac{1}{2}$ inch wide by over $\frac{1}{4}$ inch but not more than 2 inches long. Example: The common stage of so-called "peck" in cypress and incense cedar.

A *large pocket rot* (Pl. IX) is a pocket or soft area larger than $\frac{1}{2}$ inch wide by 2 inches long. Examples: Brown pocket rot of redwood; very advanced stage of so-called "peck" in cypress and incense cedar.

DISCOLORATIONS.

(190) Discolorations or stain on or in lumber are due to a number of different causes, but may be roughly divided into two classes as to origin and three classes as to appearance.

ORIGIN.

Miscellaneous discolorations are stains caused by weathering, chemical action, etc. Pile burn is a yellow or brown stain developing in air-seasoned stock; kiln burn is a yellow or brown stain developing in kiln-dried stock. Stains sometimes follow insect attack, bird peck, etc.

Fungous discolorations are caused by two sorts of fungi, mold fungi and wood-destroying fungi. The first class causes blemishes or surface stains which may be easily planned off, and also a few deeper penetrating stains of which the common blue stain is an example; the second class causes the various discolorations which indicate incipient decay. Wood stained by mold fungi is only very slightly weakened, if at all, but wood discolored by the attack of wood-destroying fungi may be greatly reduced in strength.

APPEARANCE.

A *light discoloration* (Pl. X) is a slight difference in color which will not materially impair the appearance of a piece if given a natural finish.

A *medium discoloration* (Pl. X) is a pronounced difference in coloring which, although it does not obscure the grain of the wood, would customarily be objectionable in a natural but not in a painted finish.

A *heavy discoloration* (Pl. X) is a difference in color so pronounced as practically to obscure the grain of the wood.

GUM SPOTS AND STREAKS.

(191) A *gum spot* or *streak* (Pl. X) is an accumulation of gumlike substance occurring as a small patch or streak in a piece. It may occur in conjunction with a bird peck or other injury to the growing wood.

HOLES.

(192) *Holes* in wood may extend partially or entirely through the piece. They are enumerated as knot holes, dog holes, picaroon holes, nigger tears, bird pecks, insect holes (including pin, shot, spot, and grubworm), metal and wooden rafting-pin holes, through pitch pockets, and the like.

When holes are permitted, the average of the maximum and minimum diameters, measured at right angles to the direction of the hole, shall be used in measuring the size, unless otherwise stated.

A *pin wormhole* (Pl. XI) is one not over $\frac{1}{16}$ inch in diameter.
A *small grub wormhole* (Pl. XI) is one over $\frac{1}{16}$ but not more than $\frac{1}{4}$ inch in diameter.
A *large grub wormhole* (Pl. XI) is one over $\frac{1}{4}$ inch in diameter.

IMPERFECT MANUFACTURE.

(193) *Imperfect manufacture* includes all defects or blemishes which are produced in the manufacturing processes, such as chipped grain, torn grain, loosened grain, nonuniform width or thickness, skips in dressing, mismatching, miscut, machine gouge, machine burn, and insufficient tongue or groove.

Chipped grain (Pl. XII) means that a part of the surface is chipped or broken out in very short particles below the line of cut, and, as usually found, should not be classed as a defect unless it is present in excess of 25 per cent of the area. It seldom exceeds $\frac{1}{64}$ inch in depth.

Torn grain (Pl. XII) means that a part of the wood is torn out in reasonably long pieces, and in depth is of four distinct characters—slight, medium, heavy, and deep. In area, a patch of torn grain does not exceed the product of the width of a piece by 3 inches of its length.

Slight torn grain is not over $\frac{1}{32}$ inch in depth.
Medium torn grain is over $\frac{1}{32}$ but not more than $\frac{1}{16}$ inch in depth.
Heavy torn grain is over $\frac{1}{16}$ but not more than $\frac{1}{8}$ inch in depth.
Deep torn grain is over $\frac{1}{8}$ inch in depth.

Loosened grain (Pl. XII) means that a small portion of the wood has become loosened but not displaced. This usually appears as incipient shake at the points where the annual layers of growth come to the surface.

Raised grain is a roughened condition of the surface of dressed lumber in which the hard summer wood ring is raised above the softer spring wood but not torn loose from it.

A *skip* is an area on a piece that failed to surface smooth. A *slight skip* is one whose area does not exceed the product of the width of a piece by 3 inches of its length.

Mismatched material (Pl. XII) is worked material that does not fit tightly at all points of contact between adjoining pieces or in which the surfaces of adjoining pieces are not in the same plane.

A *slight mismatch* is a surface variation not over $\frac{1}{64}$ inch.
A *medium mismatch* is a surface variation over $\frac{1}{64}$ but not more than $\frac{1}{32}$ inch.
A *heavy mismatch* is a surface variation more than $\frac{1}{32}$ inch.

A *machine gouge* (Pl. XIII, fig. 1) is a groove across a piece due to the machine cutting below the desired line of cut.

A *machine burn* (Pl. XIII, fig. 2) is a darkening or charring of the wood due to overheating by the machine knives.

Miscut lumber (Pl. XIII, fig. 3) is that which has a marked variation in thickness or width at different places on a piece, such as results from a waving of the saw during manufacture.

KNOTS.

(194) Knots shall be classified according to size, form, quality, and occurrence.

The average of the maximum and minimum diameters shall be used in measuring the size of knots unless otherwise stated.

SIZE.

A *pin knot* (Pl. XIV) is one not over $\frac{3}{8}$ inch in diameter.
A *small knot* (Pl. XIV) is one over $\frac{3}{8}$ but not more than $\frac{3}{4}$ inch in diameter.
A *medium knot* (Pl. XIV) is one over $\frac{3}{4}$ but not more than $1\frac{1}{2}$ inches in diameter.
A *large knot* (Pl. XIV) is one over $1\frac{1}{2}$ inches in diameter.

FORM.

A *round knot* (Pl. XIV) is one whose maximum diameter is not over one and one-half times its minimum diameter.

An *oval knot* (Pl. XV) is one whose maximum diameter is more than one and one-half but not more than three times its minimum diameter.

A *spike knot* (Pl. XV) is one sawed in a lengthwise direction whose maximum diameter is over three times its minimum diameter.

QUALITY.

A *sound knot* (Pl. XIV) is solid across its face, as hard as the surrounding wood, and shows no indications of decay. It may vary in color from red to black.

An *unsound knot* (Pl. XV) is solid across its face, apparently as hard as the surrounding wood, but containing incipient decay.

A *decayed knot* (Pl. XV) is softer than the surrounding wood and contains advanced decay.

A *tight knot* (Pl. XIV) is one so fixed by growth or position that it will firmly retain its place in the piece.

A *loose knot* is one not held firmly in place by growth or position.

An *intergrown knot* (Pl. XIV) is one whose growth rings are completely intergrown with those of the surrounding wood.

An *encased knot* (Pl. XV) is one whose growth rings are not intergrown and homogeneous with the growth rings of the surrounding wood. The encasement may be partial or complete.

A *water-tight knot* (Pl. XIV) is one whose growth rings are completely intergrown with those of the surrounding wood on one face of the piece and which is sound on that face.

A *pith knot* (Pl. XVI) is a sound knot, except that it has a pith hole in it. The hole rarely exceeds ½ inch in diameter.

A *hollow knot* (Pl. XVI) is an apparently sound knot with a relatively large hole in it.

OCCURRENCE.

A *single knot* is one occurring by itself with the fibers of the wood in which it occurs deflected around it.

A *knot cluster* (Pl. XVII) is two or more knots grouped together as a unit with the fibers of the wood deflected around the entire unit. A group of single knots is not a knot cluster.

Branch knots (Pl. XVIII) are two or more knots branching from a common center.

PITCH.

(195) *Pitch* (Pl. XIX) is a poorly defined accumulation of resin in the wood cells in a more or less irregular patch.

PITCH STREAKS.

(196) A *pitch streak* (Pl. XX, fig. 1) is a well-defined accumulation of pitch in the wood cells in a more or less regular streak.

A *small pitch streak* is one not over one-twelfth the width by one-sixth the length of the face on which it occurs.

A *medium pitch streak* is one over one-twelfth but not more than one-sixth the width by over one-sixth but not more than one-third the length of the face on which it occurs.

A *large pitch streak* is one over one-sixth the width by one-third the length of the face on which it occurs.

PITCH POCKETS.

(197) A *pitch pocket* (Pl. XX, figs. 2 and 4) is a well-defined opening between annual layers of growth usually containing more or less pitch, either solid or liquid. Bark may also be present in the pocket.

A *scab pitch pocket* (Pl. XX, fig. 3) is one appearing on a surface sawed parallel with or tangential to the annual layers of growth.

A *very small pitch pocket* is one not over ⅛ inch in width and not over 2 inches in length.

A *small pitch pocket* is one whose maximum width may increase from ⅛ to not over ¼ inch, provided a maximum length of 4 inches decreases to 2 inches proportionately as the width increases.

A *medium pitch pocket* is one whose maximum width may increase from ⅛ to not over ⅜ inch, provided a maximum length of 9 inches decreases to 3 inches proportionately as the width increases.

A *large pitch pocket* is one whose width or length exceeds the sizes stated as permissible for a medium pitch pocket.

PITCH SEAMS.

(198) A *pitch seam* (Pl. XIX) is a shake or check which occurs in the living tree and becomes filled with pitch.

PITH.

(199) *Pith* (Pl. XXI) is the small soft core occurring in the structural center of a log. The wood immediately surrounding the pith often contains small checks, shake, or numerous pin knots, and is often discolored; any such combination of defects and blemishes is known as *heart center*.

PITH FLECKS.

(200) A *pith fleck* (Pl. XXI) is a narrow streak, usually brownish, up to several inches in length on the face of a piece, resulting from burrowing of the larva of an insect in the growing tissue of cells of the tree.

SHAKES.

(201) A *shake* is a lengthwise separation of the wood, the greater part of which occurs between the growth rings. (Thus, any shake is a ring shake.)

A *fine shake* (Pl. XXII) is one with a barely perceptible opening.
A *slight shake* is one with more than a perceptible opening but not over $\frac{1}{32}$ inch wide.
A *large shake* is one with an opening over $\frac{1}{32}$ but not more than $\frac{1}{8}$ inch wide.
An *open shake* (Pl. XXII) is one with an opening over $\frac{1}{8}$ inch wide.
A *through shake* is one extending from one surface through the piece to the opposite face or to an adjoining face.
A *round shake* is one completely encircling the pith.
A *cup shake* is one that does not completely encircle the pith.

SPLITS.

(202) A *split* is a lengthwise separation of the wood due to the tearing apart of the wood cells.

A *short split* is one whose length does not exceed either the width of a piece or one-sixth its length.
A *medium split* is one whose length exceeds the width of a piece, provided it does not exceed one-sixth its length.
A *long split* is one whose length exceeds one-sixth the length of a piece.

WANE.

(203) *Wane* (Pl. XXII) is bark or the lack of wood from any cause on the edge or corner of a piece.

Slight wane is $\frac{1}{4}$ inch wide on the face, one-sixth the length of the piece, and one-fourth the thickness.
Medium wane is over $\frac{1}{4}$ but not more than $\frac{1}{2}$ inch wide on the face, one-sixth the length of the piece, and one-fourth the thickness.
Large wane is over $\frac{1}{2}$ but not more than 1 inch wide on the face, one-third the length of the piece, and one-half the thickness.

WARPING.

(204) *Warping* (see p. 66) is any variation from a true or plane surface. It includes crook, bow, cup, and twist, or any combination of these.

Crook is a deviation edgewise from a straight line drawn from end to end of a piece and is measured at the point of greatest distance from the straight line. It is known as slight, small, medium, and large.

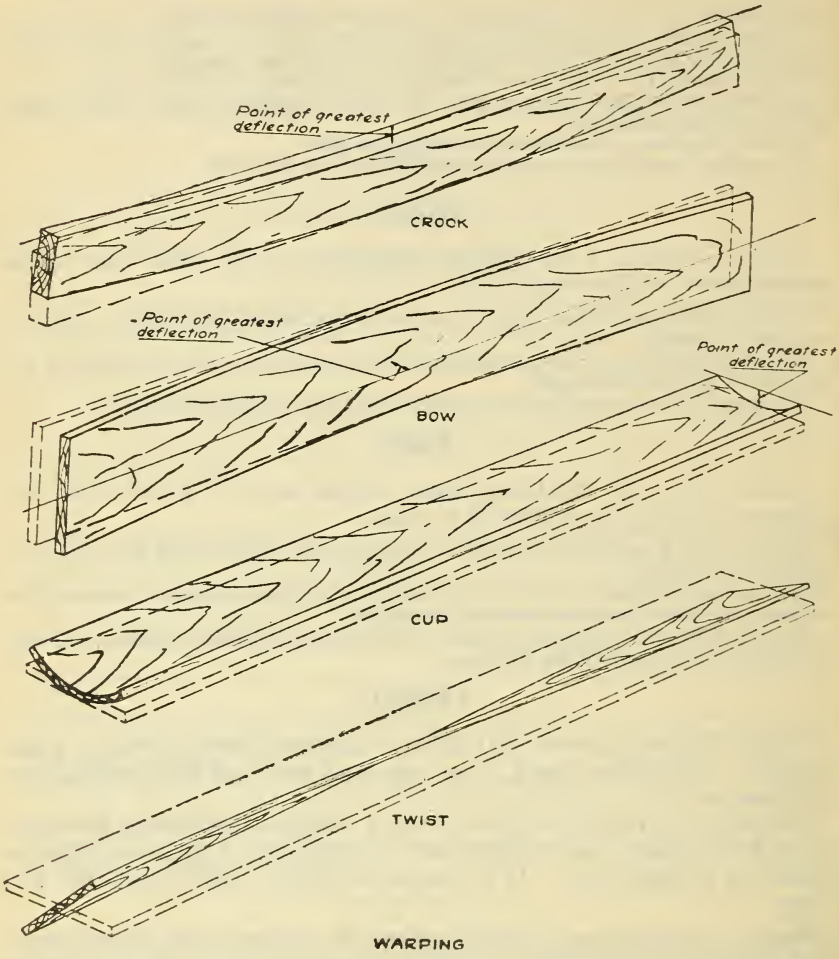
Based on a piece 4 inches wide and 16 feet long, the distances for the different degrees of crook shall be: For *slight crook*, a maximum of 1 inch; *small crook*, 1½ inches; *medium crook*, 3 inches; and *large crook*, over 3 inches. For wider pieces it shall be $\frac{1}{8}$ inch less for each additional 1 inch of width. Shorter or longer pieces may have the same curvature.

Bow is a deviation flatwise from a line drawn from end to end of a piece and is measured at the point of greatest distance from the straight line.

Cupping is the curving of a piece across the grain or width of a piece. It is measured at the point of greatest deviation from a straight line drawn from edge to edge of a piece.

Based on a piece 12 inches wide, the distances for the different degrees of cup shall be: For *slight cup*, a maximum of $\frac{1}{4}$ inch; *medium cup*, $\frac{1}{2}$ inch; and *large cup*, $\frac{3}{4}$ inch. Narrower or wider pieces may have the same curvature.

Twisting is the turning or winding of the edges of a piece so that the four corners of any face are no longer in the same plane (i. e., it is the twisting of an edge around the axis of a piece).



NOMENCLATURE OF SOFTWOOD LUMBER.

(205) Lumber cut from the commercial species of softwoods shall be designated according to the following list:

The present standard common name for each species is given first, followed by the scientific name in italics. Other names by which lumber cut from the species is also known are given, but the use of these names will not be considered standard. Lumber purchased or sold under a group name (i. e., cedars, or hemlocks) may include any or all of the various species falling in that group whether listed here or not.

(206) CEDARS.

ALASKA CEDAR (*Chamaecyparis nootkatensis*). Also known as yellow cedar, yellow cypress, Sitka cypress, Nootka cypress, Alaska cypress.

[EASTERN] RED CEDAR (*Juniperus virginiana*). Also known as juniper, savin, cedre, pencil cedar, Tennessee red cedar.

INCENSE CEDAR (*Libocedrus decurrens*). Also known as white cedar, post cedar, juniper, California post cedar.

NORTHERN WHITE CEDAR (*Thuja occidentalis*). Also known as white cedar, arborvitæ, vitæ.

PORT ORFORD CEDAR (*Chamaecyparis lawsoniana*). Also known as Oregon cedar, white cedar, Lawson's cypress, yellow cedar.

SOUTHERN WHITE CEDAR (*Chamaecyparis thyoides*). Also known as swamp cedar, post cedar, juniper.

WESTERN RED CEDAR (*Thuja plicata*). Also known as red cedar, canoe cedar, shingle cedar, western cedar, gigantic or Pacific red cedar, arborvitæ.

(207) CYPRESS.

CYPRESS (*Taxodium distichum*). Also known as southern cypress, red cypress, yellow cypress, black cypress, white cypress, swamp cypress, bald cypress.

(208) DOUGLAS FIR.

DOUGLAS FIR (*Pseudotsuga taxifolia*). Also known as red fir, yellow fir, spruce, Douglas spruce, Oregon pine, red pine, Puget Sound pine, mountain pine.

(209) THE TRUE FIRS.

ALPINE FIR (*Abies lasiocarpa*). Also known as balsam, white fir, white balsam, pumpkin tree, mountain balsam, down-cone fir.

BALSAM FIR (*Abies balsamea*). Also known as balsam, Canada balsam, balm of Gilead fir, blister pine, fir pine, fir tree, silver pine, sapin.

CORKBARK FIR (*Abies arizonica*).

LOWLAND WHITE FIR (*Abies grandis*). Also known as grand fir, white fir, lowland fir, silver fir, yellow fir, western white fir.

NOBLE FIR (*Abies nobilis*). Also known as red fir, larch, big tree.

RED FIR (*Abies magnifica*). Also known as California red-bark fir, California red fir.

SILVER FIR (*Abies amabilis*). Also known as amabilis fir, white fir, red fir, red silver fir, larch.

WHITE FIR (*Abies concolor*). Also known as balsam fir, silver fir, California white fir, Colorado white fir, balsam, white balsam.

HEMLOCKS.

(210) EASTERN.

CAROLINA HEMLOCK (*Tsuga caroliniana*). Also known as hemlock, southern hemlock.

[EASTERN] HEMLOCK (*Tsuga canadensis*). Also known as hemlock spruce, spruce pine, Old Faithful.

(211) WESTERN.

MOUNTAIN HEMLOCK (*Tsuga mertensiana*). Also known as black hemlock, hemlock spruce, alpine western spruce.

WESTERN HEMLOCK (*Tsuga heterophylla*). Also known as West Coast hemlock, hemlock spruce, western hemlock, fir, Alaska pine, gray fir.

(212) LARCH (See Tamarack).

WESTERN LARCH (*Larix occidentalis*). Also known as tamarack, western tamarack, hackmatack, red American larch.

EASTERN PINES.

(Territory east of the Great Plains.)

(213) NORTHERN PINES.

[EASTERN] WHITE PINE (*Pinus strobus*). Also known as northern pine, northern white pine, soft pine, pumpkin pine, cork pine.

JACK PINE (*Pinus divaricata*). Also known as scrub pine, gray pine, blackjack pine, black pine, banksian pine, northern pine.

NORWAY PINE (*Pinus resinosa*). Also known as red pine, hard pine, Canadian red pine, northern pine.
VIRGINIA PINE (*Pinus virginiana*). Also known as Jersey pine, spruce pine, shortleaf pine, river pine, nigger pine, scrub pine.

(214) SOUTHERN PINES.

LOBLOLLY PINE (*Pinus taeda*). Also known as North Carolina (N. C.) pine, Arkansas soft pine, swamp pine, yellow pine, longstraw pine, oldfield pine, Rosemary pine, slash pine, shortleaf pine, bull pine, Virginia pine, sap pine, meadow pine, spruce pine.
LONGLEAF PINE (*Pinus palustris*). Also known as southern pine, yellow pine, hard pine, heart pine, pitch pine, Georgia pine, Florida pine, Texas longleaf pine.
PITCH PINE (*Pinus rigida*). Also known as longleaf pine, hard pine, yellow pine, sap pine.
POND PINE (*Pinus serotina*). Also known as yellow pine, marsh pine, meadow pine, loblolly pine, bull pine.
SHORTLEAF PINE (*Pinus echinata*). Also known as yellow pine, pitch pine, Rosemary pine, North Carolina (N. C.) pine, slash pine, oldfield pine, Arkansas soft pine, heart pine.
SLASH PINE (*Pinus caribaea*). Also known as Cuban pine, swamp pine, meadow pine, pitch pine, Florida pine.
SPRUCE PINE (*Pinus glabra*). Also known as cedar pine, white pine, poor pine.

WESTERN PINES.

(Territory west of the Great Plains.)

(215) WHITE PINES.

LIMBER PINE (*Pinus flexilis*). Also called white pine, Rocky Mountain white pine, limber-twig pine, western white pine.
SUGAR PINE (*Pinus lambertiana*). Also known as big pine, shade pine, gigantic pine.
WESTERN WHITE PINE (*Pinus monticola*). Also known as Idaho white pine, Montana white pine, silver pine, soft pine.

(216) OTHER SOFT PINES.

JEFFREY PINE (*Pinus jeffreyi*). Also known as bull pine, western black pine, sapwood pine, California white pine, Sierra red-bark pine, Peninsula black pine.
LODGEPOLE PINE (*Pinus contorta*). Also known at tamarack, white pine, black pine, spruce pine, tamarack pine, shore pine, scrub pine, sand pine, bird's-eye pine.
WESTERN YELLOW PINE (*Pinus ponderosa*). Also known as California white pine, western white pine, western soft pine, western pine, California soft pine, white pine, Arizona white pine, Oregon white pine, yellow pine, bull pine, western pitch pine.

(217) REDWOOD.

REDWOOD (*Sequoia sempervirens*). Also known as Sequoia, coast redwood, California redwood.

(218) SPRUCES.

BLACK SPRUCE (*Picea mariana*). Also known as eastern spruce, swamp spruce, white spruce, water spruce, juniper.
BLUE SPRUCE (*Picea parryana*). Also known as Colorado blue spruce, silver spruce.
ENGELMANN SPRUCE (*Picea engelmanni*). Also known as white spruce, white pine, mountain spruce, Arizona spruce.
RED SPRUCE (*Picea rubra*). Also known as eastern spruce, white spruce, yellow spruce.
SITKA SPRUCE (*Picea sitchensis*). Also known as airplane spruce, tideland spruce, western spruce.
WHITE SPRUCE (*Picea glauca*). Also known as eastern spruce, cat spruce, bog spruce, skunk spruce.

(219) TAMARACK. **(See Larch.)**

TAMARACK (*Larix laricina*). Also known as larch, eastern larch, black larch red larch, American larch, hack, hackmatack, juniper.

LUMBER DEFINITIONS AND ABBREVIATIONS.

DEFINITIONS.

(220) *Lumber* is wood sawed, split, or otherwise cut directly from a tree to definite sizes and shapes. Since such wooden products as shingles, lath, veneer, etc., are usually defined separately, the common conception of lumber as used in a restricted sense is the product of the saw and planing mill not further manufactured than by sawing, resawing, passing lengthwise through a standard planing machine, and working to a special form.

(221) *Softwood lumber* is that cut from the trees known as Gymnosperms (also called needle or scale-leaved trees, conifers, evergreens, nonporous woods, woods without true vessels, and polycotyledons).

(222) *Hardwood lumber* is that cut from the trees known as Angiosperms (also called broad-leaved trees, deciduous trees, porous woods, woods with true vessels, and dicotyledons).

(223) *Rough lumber* is that which has been produced from a tree, as by sawing, and not further manufactured.

(224) *Dressed lumber* is that which has been brought to a smooth surface irrespective of form or method.

(225) *Surfaced lumber* is that which has been dressed to a plane surface. It is commonly surfaced one side (S1S), two sides (S2S), one edge (S1E), two edges (S2E), four sides (S4S), or a combination of sides and edges (such as S1, S1E, S2, S1E, or S1, S2E).

(226) *Matched lumber* is that which is dressed to a tight-fitting tongue-and-groove joint at the edges or ends. Matched stock may be ordered:

D&M—in which case one or both sides may be dressed and center or standard matched, at the option of the manufacturer.

S1S&M or S2S&M—in which case the manufacturer may center or standard match the material but must surface one or both sides as ordered.

S1S&CM, S2S&CM, S1S&SM, or S2S&SM—in which case the material must be surfaced one or both sides and center or standard matched as ordered.

(227) *Ship-lapped lumber* is that which is dressed on the edge to a tight-fitting rabbeted or lapped joint. It is dressed one or two sides at the option of the manufacturer, unless otherwise ordered.

(228) *Patterned lumber* is that which is dressed to a curved form or pattern.

(229) *Yard lumber* is that which is manufactured and classified into those sizes, shapes, and qualities required for ordinary domestic and industrial uses. It is ordinarily stocked in a yard as a result of demand for certain sizes and qualities. It is seldom over 4 inches in thickness.

(230) *Factory lumber* is that which is sawed and classified into those sizes and qualities required in the manufacture of special products. It is graded on the basis of the percentage of the total area of each piece which can be obtained in specified sizes and qualities.

(231) *Structural timber* is all products of wood in which strength is the controlling element in its selection and use. It may be of any size, and in the larger sizes is customarily manufactured on special orders.

(232) *Dimension* as here used is that form of lumber manufactured at the sawmill in standard sizes for use where strength, stiffness, and uniformity of size are the essential requirements. It is usually 2

inches in thickness, occasionally thicker. The better grades are used principally for general construction purposes and the lower grades for temporary construction or, after remanufacture, for special purposes. It may be graded under the rules for structural timbers when required.

(233) *Boards* are lumber customarily less than 2 inches thick. The ratio of the width to thickness and of length to width is usually large. Pieces up to 6 inches wide are sometimes known as strips and fencing.

(234) *Scantling* customarily is light dimension in which the ratio of width to thickness is small. The majority of scantling is 2 to 4 inches thick and 2 to 6 inches wide.

(235) *Planks and joists* customarily are light dimension or structural material in which the ratio of width to thickness is large. The majority of planks and joists are 2 to 4 inches thick and over 6 inches wide. The name under which such material is sold depends largely on the use to which it is to be put.

(236) *Heavy joists and thick planking* customarily are thick dimension or structural material in which the ratio of width to thickness is large, such as material 4 to 6 inches thick and 8 or more inches wide. The name under which such material is sold depends largely on the use to which it is to be put.

(237) *Timbers* customarily are thick dimension or structural material in which the ratio of width to thickness is small, such as material 4 to 6 inches thick and 4 to 8 inches wide, or 6 or more inches thick and 6 or more inches wide.

(238) *Small dimension stock* is lumber, usually in small sizes, which is cut from boards, planks, slabs, edgings, and trimmings, or directly from the log, to different sizes and shapes required by the secondary wood-using industries in the manufacture of fabricated articles.

STANDARD ABBREVIATIONS.

(239) Abbreviations commonly used in the lumber industry are as shown in the following list. Those followed by definitions and explanations shall be standard. Other abbreviations, followed by references to the standard abbreviation, are included in alphabetical order for information only. Their use is not recommended.

AD Air-dried.
a. l. All lengths.
av. Average.
av. w. Average width.
av. l. Average length.
a. w. All widths.
B1S Beaded one side.
B2S Beaded two sides.
B&CB1S See E&CB1S.
B&CB2S See E&CB2S.
BBS Box bark strips.
bd. Board.
bd. ft. Board foot. Also B. F.
bdl. Bundle.
bdl. bk. s. Bundled bark strips.
Bet. See Btr.
Bev. Beveled.
B. F. See bd. ft.
B/L Bill of lading.
b. m. Board (foot) measure.
Btr. Better Also Bet.
Ceil. See Clg.
C. G. See V. G.
C/G See Clg.
c. & f. (named port). Cost and freight to named port.

Term used when the seller is ready to go farther than the delivery of his goods upon a vessel and is willing to pay transportation to another port.

c. i. f. (named port). Cost, insurance, and freight to a named port.

Term used when the seller desires to quote a price covering the cost of the goods, the marine insurance on the goods, and all transportation charges to the point of delivery.

c. i. f. e. (named port). Cost, insurance, freight, and exchange to a named port.

This is the same as c. i. f. with the additional provision that the seller guarantees the buyer against loss due to a decline in the rate of exchange.

Cl. See Clr.

Clg. Ceiling. Also C/G and Ceil.

Clr. Clear. Also Cl.

CM Center matched; i. e., the tongue-and-groove joints are worked along the center of the edges of the piece.

Com. Common.

Coop. Cooperage (stock).

C. S. See D. S.

C/S See Csg.

Csg. Casing. Also C/S.

Ctg. Crating.

cu. ft. Cubic foot.

Cust. Custom (sawed).

D&CM Dressed (one or two sides) and center matched.

D&H Dressed and headed; i. e., dressed one or two sides and worked to tongue-and-groove joints on both the edges and the ends.

D&M Dressed and matched; i. e., dressed one or two sides and tongued and grooved on the edges. The match may be center or standard.

D&SM Dressed (one or two sides) and standard matched.

D2S&CM Dressed two sides and center matched.

D2S&M Dressed two sides and (center or standard) matched.

D2S&SM Dressed two sides and standard matched.

Dim. Dimension.

D. S. Drop siding. Also D/S. Synonymous with cove siding (C. S.), novelty siding (N. S. and Nov. Sdg.), and German siding (G. S.).

D/S See D. S.

E. Edge. Also Ed.

E&CB1S Edge and center bead one side; i. e., surfaced one or two sides and with a longitudinal edge and center bead on a surfaced face. Also B&CB1S.

E&CB2S Edge and center bead two sides; i. e., all four sides surfaced and with a longitudinal edge and center bead on the two faces. Also B&CB2S.

ECM Ends center matched.

E&CV1S Edge and center V one side; i. e., surfaced one or two sides and with a longitudinal edge and center V-shaped groove on a surfaced face. Also V&CV1S.

E&CV2S Edge and center V two sides; i. e., all four sides surfaced and with a longitudinal edge and center V-shaped groove on the two faces. Also V&CV2S.

Ed. See E.

E. G. See V. G.

EM End matched, either center or standard.

ESM Ends standard matched.

exp. Export (lumber or timber).

Fact. See Fcty.

FAS Firsts and Seconds, a combined grade of the two upper grades of hardwoods.

f. a. s. vessel (named port). Free alongside vessel at a named port.

Term used when the seller desires to quote a price covering delivery of the goods alongside a vessel and within reach of its loading tackle.

f. bk. Flat back.

Fcty. Factory (lumber). Also Fact.

F. G. Flat grain. Synonymous with slash grain (S. G.) and plain sawed (P. S.).

Flg. Flooring. Also F/G.

f. m. See s. m.

f. o. b. (named point). Free on board at a named shipping point.

Term used when the price quoted applies only to an inland shipping point and the seller merely undertakes to load the goods on or in cars or lighters furnished by the railroad company serving the industry, or most conveniently located to the industry, without other designation as to routing.

f. o. b. (named point). Freight prepaid to (named point). Free on board at a named point and freight prepaid to a named point.

Term used when the seller quotes a price, including transportation charges, to a given point without assuming responsibility for the goods after obtaining a clean bill of lading at point of origin.

f. o. b. (named point). Freight allowed to (named point). Free on board at a named point and freight allowed to a named point.

Term used where the seller wishes to quote a price from which the buyer may deduct the cost of transportation to the point of destination without the seller assuming responsibility for the goods after obtaining a clean bill of lading at the point of origin.

f. o. b. cars (named destination point). Free on board cars at a named destination point.

Term used when the seller desires to quote a price covering the transportation of the goods to a given point, assuming responsibility for loss and/or damage up to that point.

f. o. b. cars (named point) l. c. l. Free on board cars at a named point less carload lots.

Term used when the goods on which a price is quoted to a given point constitutes less than a carload lot.

f. o. b. (named port) lighterage free. Free on board at a named port with lighterage free.

Term used when seller desires to quote a price which will include the expense of transportation of the goods by rail to the seaboard, including lighterage.

f. o. b. vessel (named port). Free on board vessel at a named port.

Term used when the seller desires to quote a price covering all expenses up to and including delivery of the goods upon a vessel at a named port.

f. o. k. Free of knots.
f. o. w. First open water.
Frm. Framing.
ft. Foot or feet. Also one minute mark (′). (See Symbols.)
ft. b. m. Feet board measure.
ft. s. m. Feet surface measure.
Furn. Furniture (stock).
G. R. Grooved roofing.
G. S. See D. S.
h. bk. Hollow back.
Hdl. Handle (stock).
hdwd. Hardwood.
Hrt. Heart.
Hrtwd. Heartwood.
1s&2s Ones and twos, a combined grade of the hardwood grades of Firsts and Seconds.
Impl. Implement (stock).
in. Inch or inches. Also one second mark (″). (See Symbols.)
KD Kiln-dried. Also K/D.
k. d. Knocked down.
K/D See KD.
lbr. Lumber.
l. c. l. Less carload lots.
lgth. Length.
lgr. Longer.
lin. ft. Lineal foot; i. e., 12 inches.
Lng. Lining.
LR Log run.
LR, MCO. Log run, mill culls out.
Lth. Lath.
M Thousand. Also M.
M See M.
M. b. m. Thousand (feet) board measure.
MCO Mill culls out.
Merch. Merchantable.
m. l. Mixed lengths.
Mldg. Molding.
MR Mill run.
M. s. m. Thousand (feet) surface measure.
m. w. Mixed widths.
N. S. See D. S.
Nov. Sdg. See D. S.
No. Number.
Ord. Order.
P. Planed; used synonymously with dressed and surfaced as P2S&M, meaning planed two sides and matched.
Part'n. See Pn.
Pat. Pattern.
Pky. Pecky.
Pln. Plain, or plain sawed. See F. G.
Pn. Partition. Also Part'n.
Prod. Production. Also Prod'n.
Prod'n. See Prod.
P. S. See F. G.
Q. S. See V. G.
Qt. Quartered, when referring to hardwoods. (See also V. G.)
rd. See rnd.
rdm. Random.
res. Resawed.
Rfg. Roofing.
Rfrs. Roofers.
rip. Ripped.
r. l. Random lengths.
rnd. Round. Also rd.
R. S. See V. G.
R. Sdg. Rustic siding.
r. w. Random widths.
S&E Surfaced one side and edge.
S1E Surfaced one edge.
S2E Surfaced two edges.
S1S Surfaced one side.
S2S Surfaced two sides.
S1S1E Surfaced one side and one edge.
S2S1E Surfaced two sides and one edge.
S1S2E Surfaced one side and two edges.
S4S Surfaced four sides.
S4SCS Surfaced four sides with a calking seam on each edge.
S&CM Surfaced (one or two sides) and center matched.
S&M Surfaced and matched; i. e., surfaced one or two sides and tongued and grooved on the edges. The match may be center or standard.
S&SM Surfaced (one or two sides) and standard matched.
S2S&CM Surfaced two sides and center matched.
S2S&M Surfaced two sides and (center or standard) matched.
S2S&SM Surfaced two sides and standard matched.
Sap. Sapwood.
SB Standard bead.
Sd. Seasoned.
Sdg. Siding. Also Sidg. and S/G.
Sel. Select.
S. E. Sdg. Square-edge siding.
s. f. Surface foot; i. e., an area of 1 square foot.
Sftwd. Softwood.
S. G. See F. G.
S/G. See Sdg.
Sh. D. Shipping dry.
Ship. Shipment or shipments.
Shlp. Ship-lap. Also S-L and S/L.
Sidg. See Sdg.
S/L See Shlp.
S-L See Shlp.
s. m. Surface measure. Synonymous with face measure (f. m.).
SM Standard matched.
smkd. Smoked (dried).
smk. stnd. Smoke stained.
s. n. d. Sap no defect.
snd. Sound.
sq. Square.
Sq. E&S Square edged and sound.
Sqrs. Squares.

Std. Standard.
stnd. Stained.
stk. Stock.
Stp. Stepping.
S. W. Sound wormy.
Symbols:
″=inch or inches, as 12″.
′=foot or feet, as 12′.
x=by, as a 6″ x 8″ timber.
4/4, 5/4, 6/4, 8/4, etc.=1 inch, 1¼ inches, 1½ inches, 2 inches, etc., when referring to the size of lumber.
T&G Tongued and grooved.
TB&S Top, bottom, and sides.
Tbrs. Timbers.
V1S V one side, i. e., a longitudinal V-shaped groove on one face of a piece of lumber.
V2S V two sides, i. e., a longitudinal V-shaped groove on two faces of a piece of lumber.
V. G. Vertical grain. Synonymous with edge grain (E. G.), comb grain (C. G.), quarter-sawed (Q. S.), quartered (Qtd.), and rift-sawed (R. S.).
w. a. l. Wider, all lengths.
Wth. Width.
wdr. Wider.
Wgn. Wagon (stock).
wt. Weight.

SUMMARY OF STANDARD SIZES FOR YARD LUMBER.

TABLE 1.—*Sizes for Finishing, Common Boards, and Dimension.*

[The thicknesses apply to all widths and the widths to all thicknesses.]

Product.	Nominal size.		Dressed size based on lumber properly seasoned for the use intended.		Lengths.
	Thickness.	Width.	Thickness.	Width.	
	Inches.	*Inches.*	*Inches.*	*Inches.*	
Finishing: S1S or S2S and S1E or S2E.	⅜	3	5/16	2⅝	6 to 24 feet in multiples of 1 foot.
	½	4	7/16	3⅝	
	⅝	5	9/16	4⅝	
	¾	6	11/16	5⅝	
	1	7	13/16	6⅝	
	1¼	8	1 1/16	7½	
	1½	9	1 5/16	8½	
	2	10	1¾	9½	
	2½	11	2⅛	10½	
	3	12	2⅝	11½	
		14		13½	
		16		15½	
		18		17½	
		20		19½	
		Over 20.		½ scant.	
Common boards: S1S or S2S and S1E or S2E.	1	3	13/16	2⅝	4 to 24 feet in multiples of 1 foot.
	1¼	4	1 1/16	3⅝	
	1½	5	1 5/16	4⅝	
	2	6	1⅝	5⅝	
		7		6⅝	
		8		7½	
		9		8½	
		10		9½	
		11		10½	
		12		11½	
Dimension: S1S or S2S and S1E or S2E.	2	2	1⅝	1⅝	Do.
	2½	4	2⅛	3⅝	
	3	6	2⅝	5⅝	
	4	8	3⅝	7½	
	over 4.	10	⅜ scant.	9½	
		12		11½	
		over 12.		½ scant.	

TABLE 2.—*Sizes for Casing and Base, Molding, Siding, Flooring (except Factory), Ceiling and Partition, Ship-lap, and Dressed and Matched.*

[The thicknesses apply to all widths and the widths to all thicknesses.]

Product.	Nominal size.		Dressed size based on lumber properly seasoned for the use intended.			Lengths.
	Thickness.	Width.	Thickness.	Face width.[1]		
Casing and base[2]						4 to 20 feet in multiples of 1 foot.
Moldings[2]						Do.
Bevel Siding: Plain, bungalow, or colonial.	*Inches.* ½ by 4 ⅝ by 4	*Inches.* 4 5 6 8 10 12	*Inches.* ½ by 7/16 ⅝ by 9/16	*Inches.* 3½ 4½ 5½ 7½ 9½ 11½		3 to 20 feet in multiples of 1 foot.
				D&M.	Shiplapped.	
Rustic and drop siding	⅝ 1	4 5 6 8 10	9/16 ¾	3¼ 4¼ 5¼ 7¼	5⅛ 7⅛ 9⅛	4 to 20 feet in multiples of 1 foot.
Flooring	⅜ ½ ⅝ 1 1¼ 1½	2 3 4 5 6	7/16 9/16 11/16 1 1/16 1 5/16	1½ 2⅜ 3¼ 4¼ 5¼		Do.
Ceiling and Partition	⅜ ½ ⅝ ¾ 1	3 4 5 6	5/16 7/16 9/16 11/16 ¾	2⅜ 3¼ 4¼ 5¼		Do.
Ship-lap	1 2	4 6 8 10 12	13/16 1⅝	3⅛ 5⅛ 7⅛ 9⅛ 11⅛		4 to 24 feet in multiples of 1 foot.
Dressed and Matched	1 1¼ 1½ 2	4 6 8 10 12	¾ 1 1/16 1 5/16 1⅝	3½ 5¼ 7¼ 9¼ 11¼		Do.

[1] The over-all widths of patterned material may be computed on the following basis: Based on material 1 inch thick, the tongue shall be ½ inch wide in tongued and grooved lumber, and the lap ⅜ inch in shiplapped lumber; or, based on material 2 inches thick, the tongue shall be ⅝ inch in tongued and grooved lumber, and the lap ½ inch in ship-lapped lumber. The face width of 2-inch ship-lap or Dressed and Matched shall be ⅛ inch less than shown.

[2] Conform to patterns in Standard Molding Book.

TABLE 3.—*Sizes for Factory Flooring, Heavy Roofing, Decking, and Sheet Piling.*

[The thicknesses apply to all widths and the widths to all thicknesses.]

Nominal size.		Based on lumber seasoned for the use intended.				Lengths.
			Face width.[1]			
Thickness.	Width.	Thickness.	D&M.	Shiplapped.	Grooved for splines.	
Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	
2	4	1⅝	3⅛			6 to 24 feet in multiples of 1 foot.
2½	6	2⅛	5⅛	5	5½	
3	8	2⅝	7⅛	7	7½	
4	10	3⅝		9	9½	
	12			11	11½	

[1] The over-all widths of patterned material may be computed on the following basis: Based on material 1 inch thick, the tongue shall be ¼ inch wide in tongued and grooved lumber, and the lap ⅜ inch in shiplapped lumber; or, based on material 2 inches thick, the tongue shall be ⅜ inch in tongued and grooved lumber, and the lap ½ inch in ship-lapped lumber.

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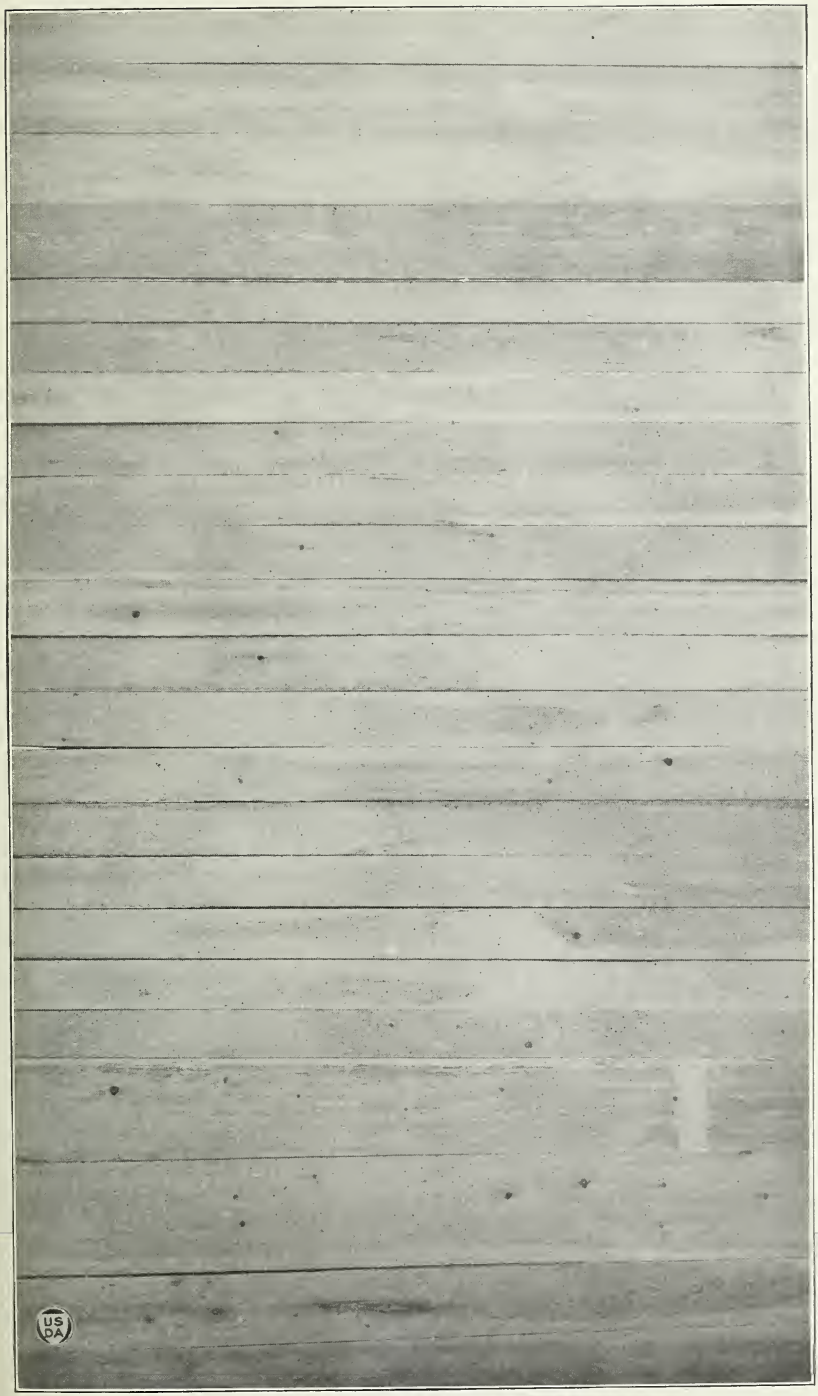


TYPICAL QUALITY SCALE OF SOFTWOOD YARD LUMBER IN SELECT GRADES.

TYPICAL QUALITY SCALE OF SOFTWOOD YARD LUMBER IN COMMON GRADES.

BARK POCKET. BIRD PECKS AND MINERAL STREAKS.

DEFECTS FOUND IN YARD LUMBER.

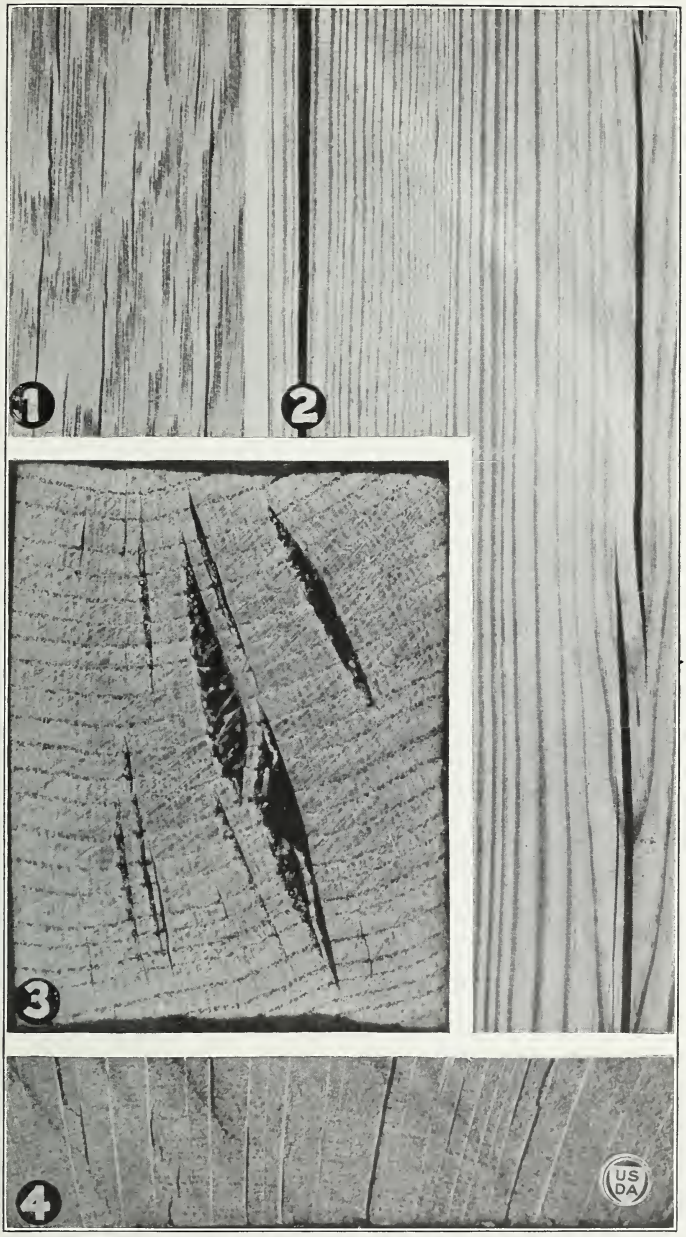


FIG. 1.—MEDIUM SURFACE CHECKS. FIG. 2.—LARGE SURFACE CHECKS. FIG. 3.—HONEYCOMBING. FIG. 4.—END AND THROUGH CHECKS.

DEFECTS FOUND IN YARD LUMBER.

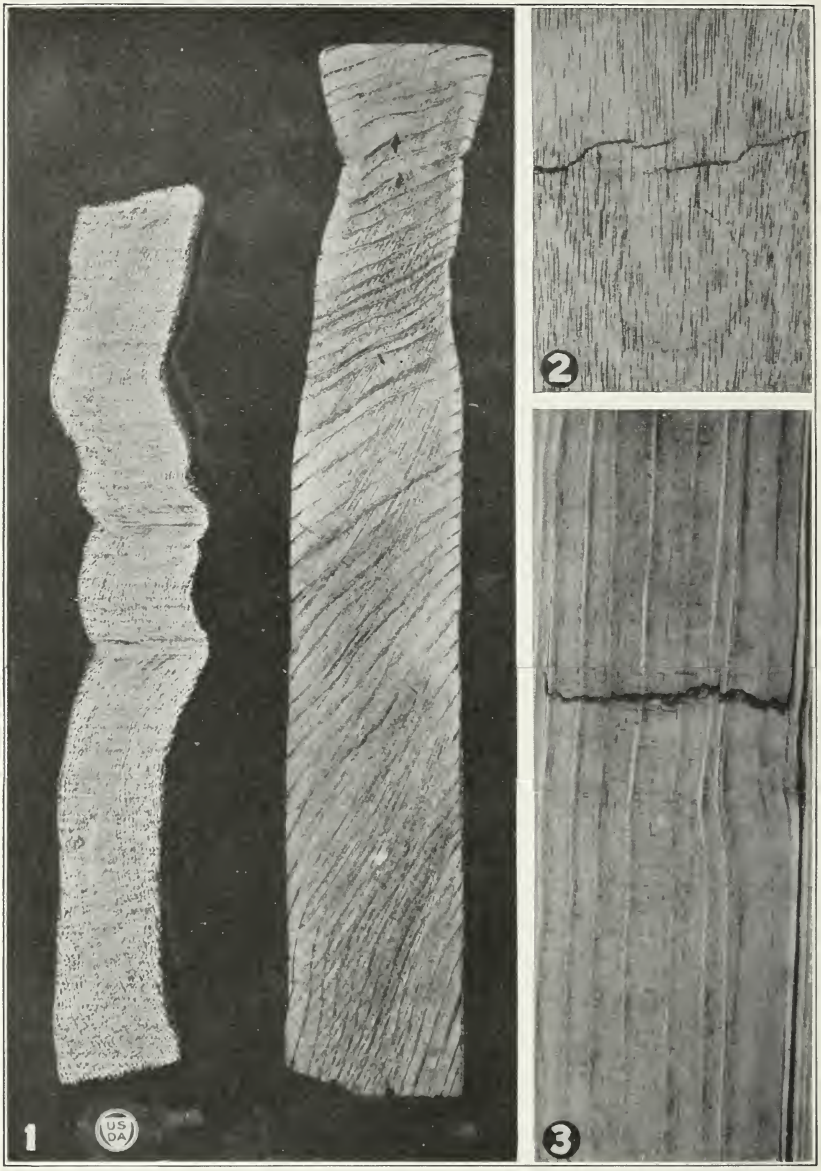
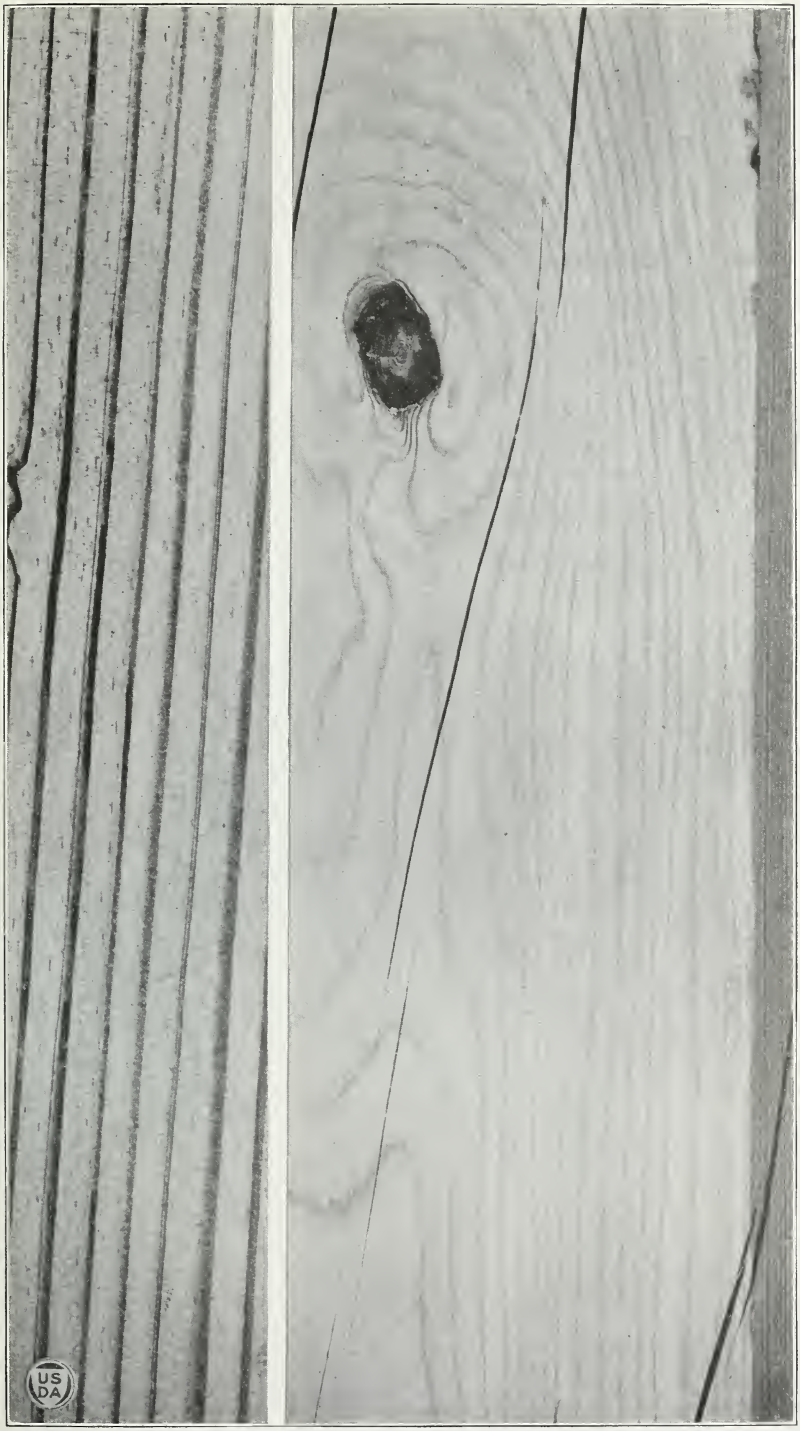


FIG. 1.—COLLAPSE. FIG. 2.—COMPRESSION FAILURE. FIG. 3.—CROSS BREAK.
DEFECTS FOUND IN YARD LUMBER.



DIAGONAL GRAIN. SPIRAL GRAIN.

DEFECTS FOUND IN YARD LUMBER.

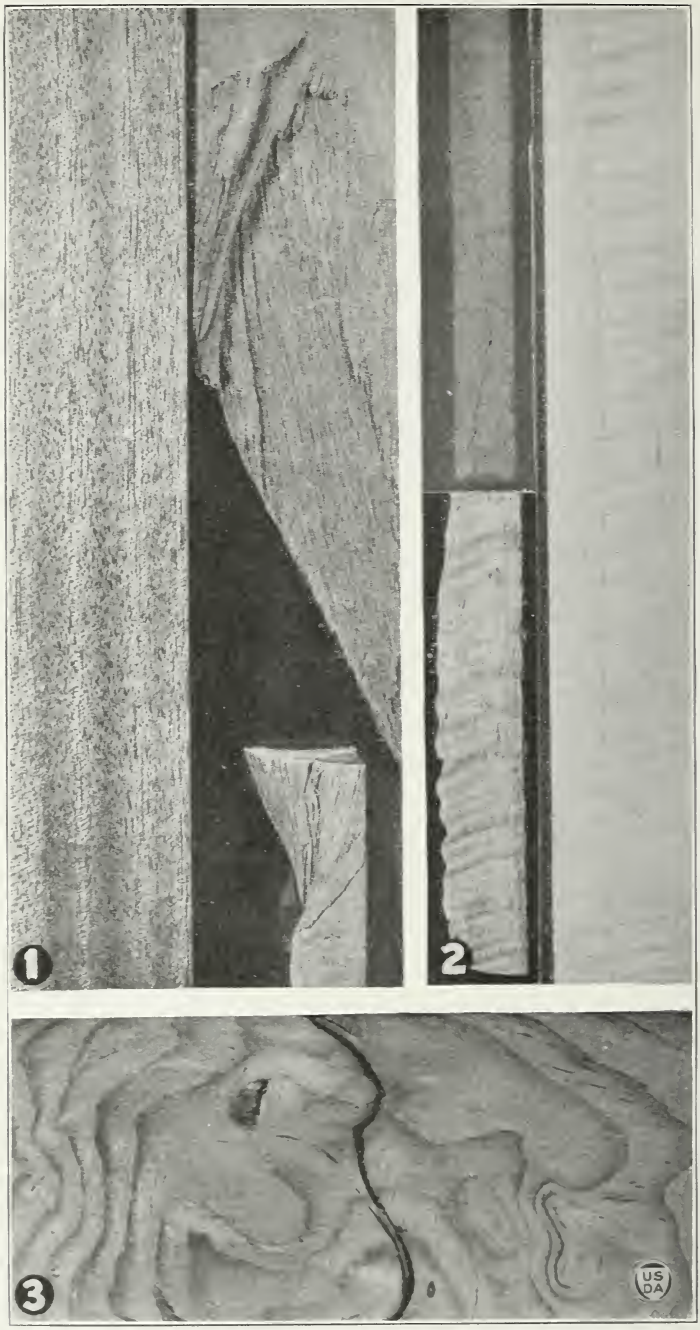
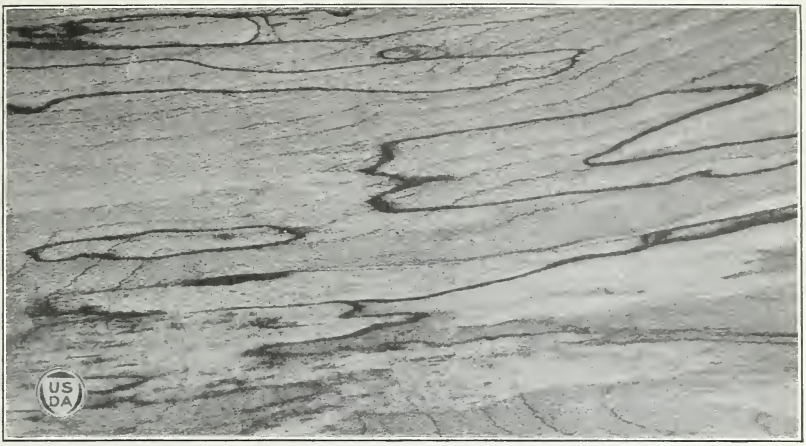
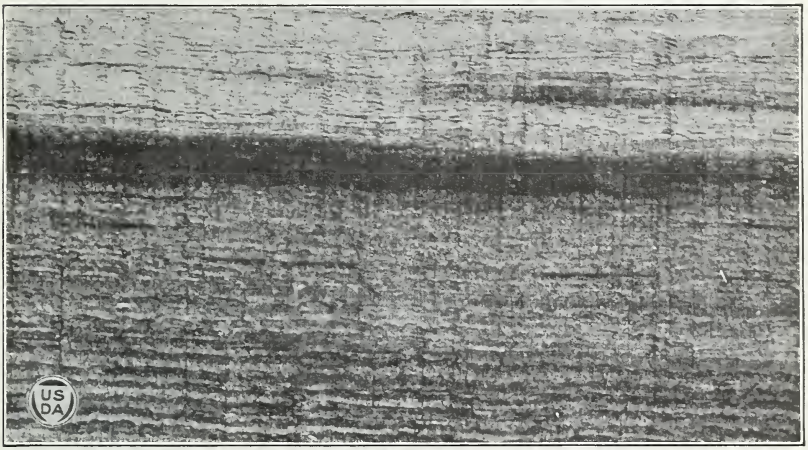


FIG. 1.—INTERLOCKED GRAIN. FIG. 2.—WAVY GRAIN.
FIG. 3.—WAVY GRAIN.

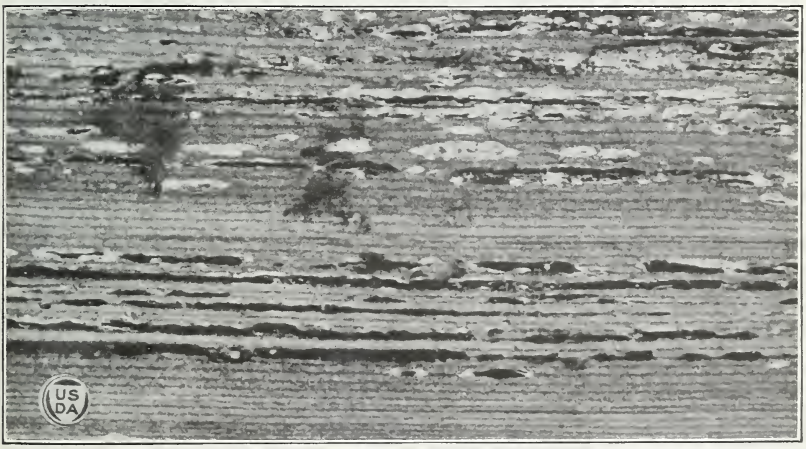
DEFECTS FOUND IN YARD LUMBER.



INCIPIENT AND ADVANCED DECAY. A WHITE ROT.

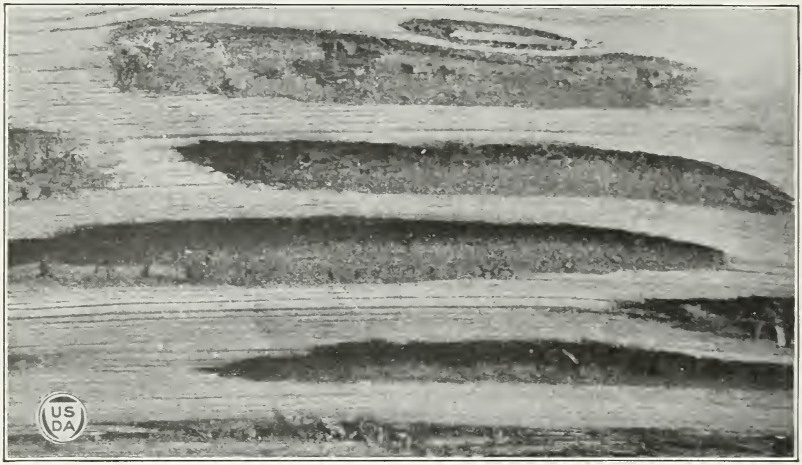


INCIPIENT DECAY. FIRM RED HEART.

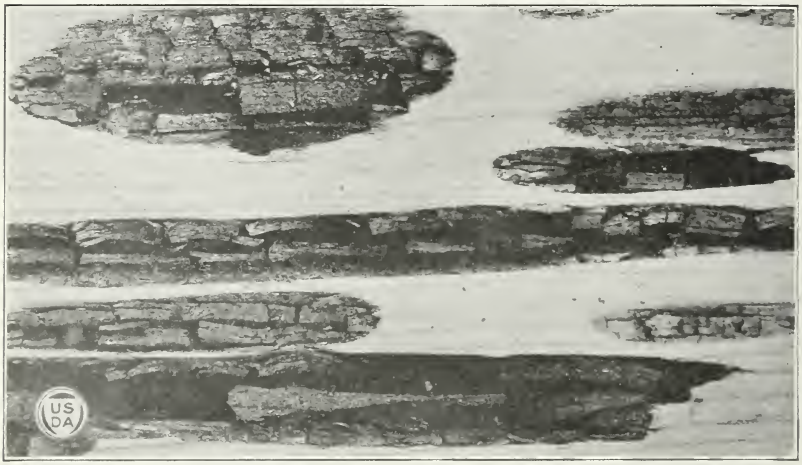


ADVANCED DECAY. SMALL POCKET ROT.

DEFECTS FOUND IN YARD LUMBER.

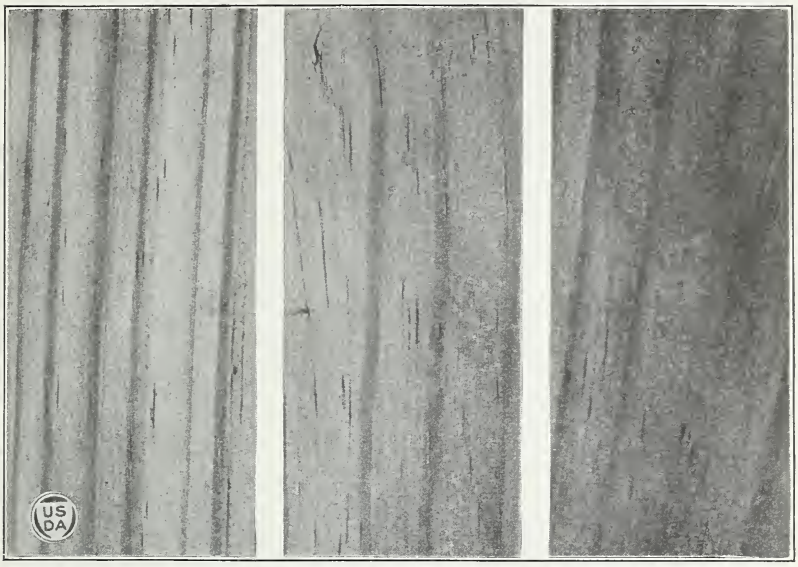


ADVANCED DECAY. MEDIUM AND LARGE POCKET ROT.

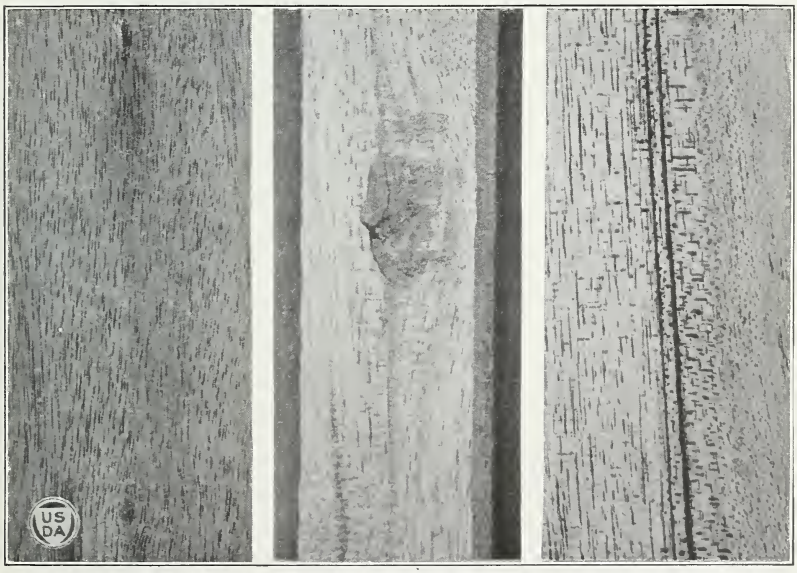


ADVANCED DECAY. A BROWN ROT. MEDIUM AND LARGE POCKET ROT.

DEFECTS FOUND IN YARD LUMBER.

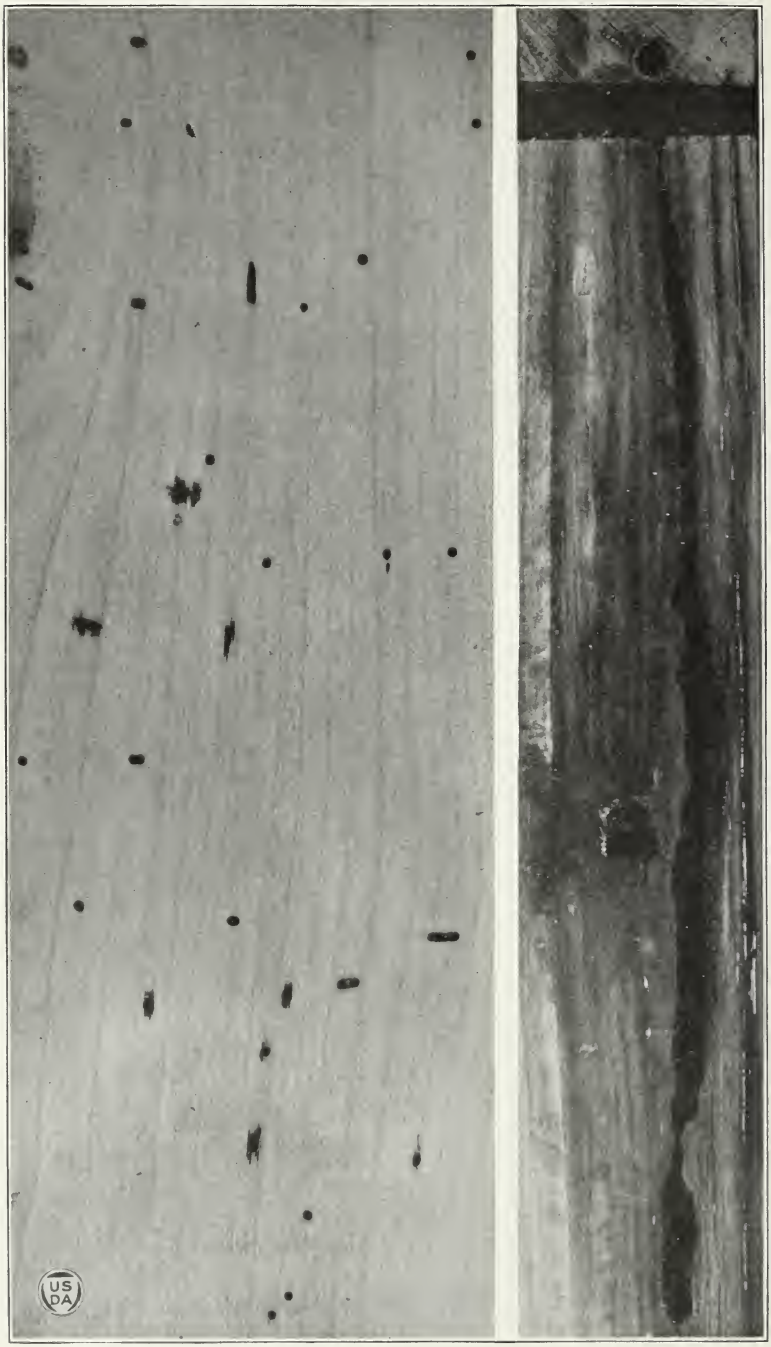


LIGHT DISCOLORATION. MEDIUM DISCOLORATION. HEAVY DISCOLORATION.



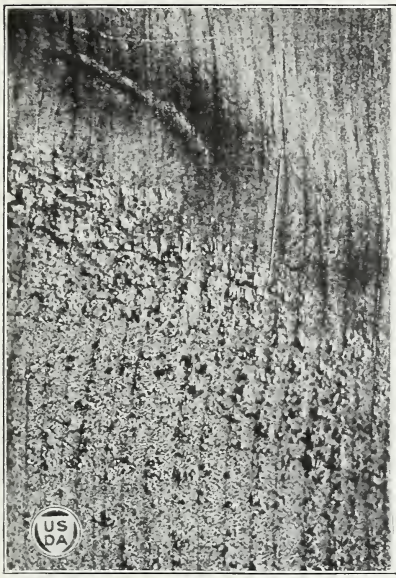
GUM SPOTS. GUM SPOTS AND STREAKS. GUM STREAKS.

DEFECTS FOUND IN YARD LUMBER.



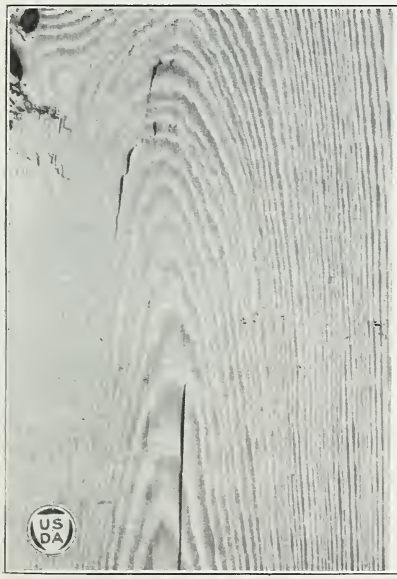
PINWORM HOLES. GRUBWORM HOLES.

DEFECTS FOUND IN YARD LUMBER.

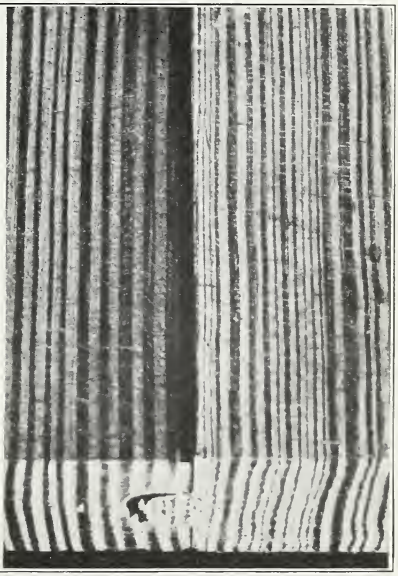


CHIPPED GRAIN.

TORN GRAIN.



LOOSENED GRAIN.



MISMATCH.

DEFECTS FOUND IN YARD LUMBER.

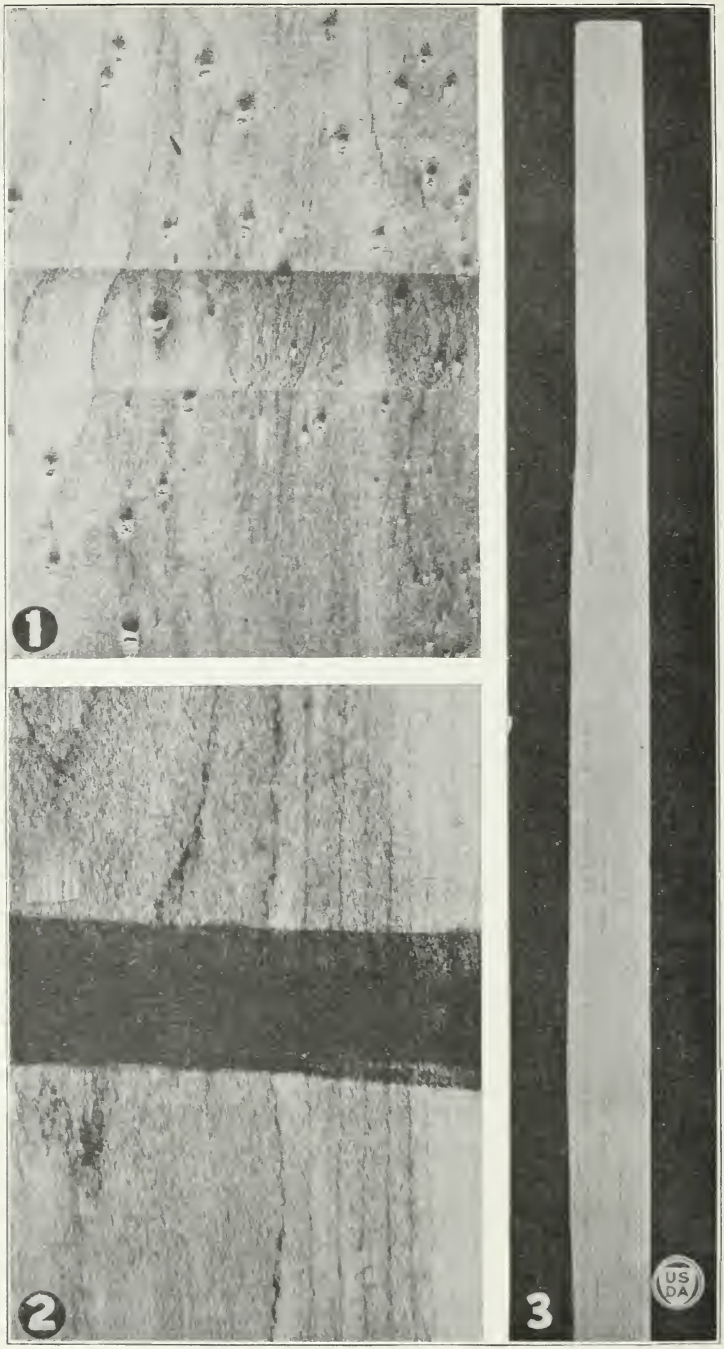
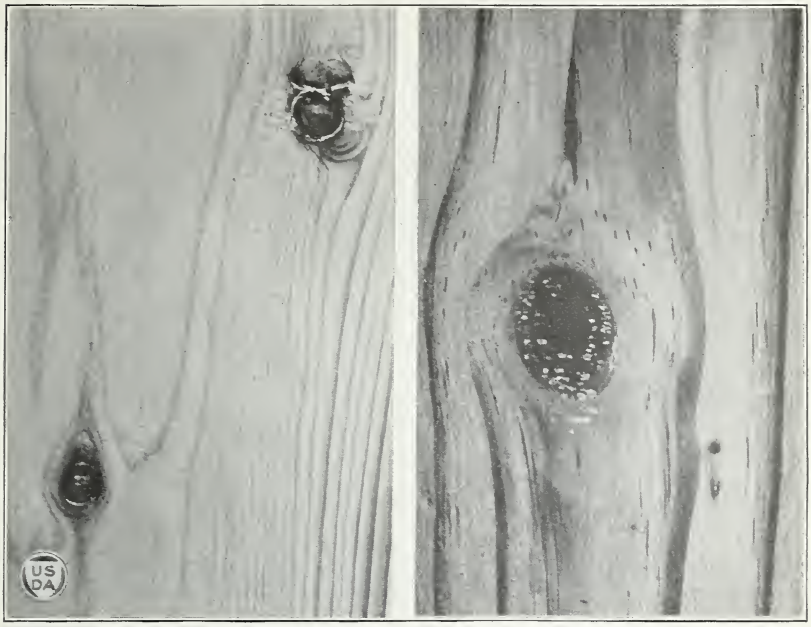
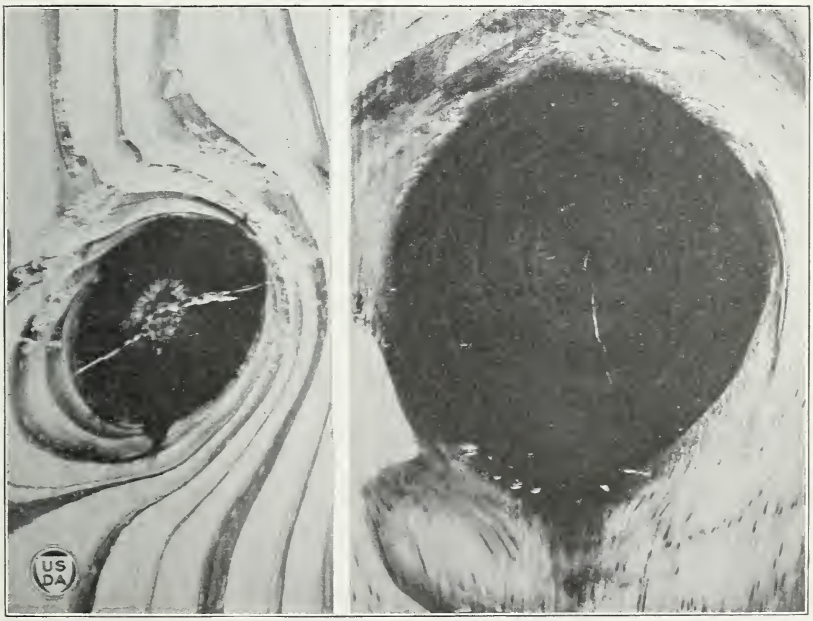


FIG. 1.—MACHINE GOUGE. FIG. 2.—MACHINE BURN.
FIG. 3.—MISCUT LUMBER (REDUCED IN SIZE).

DEFECTS FOUND IN YARD LUMBER.

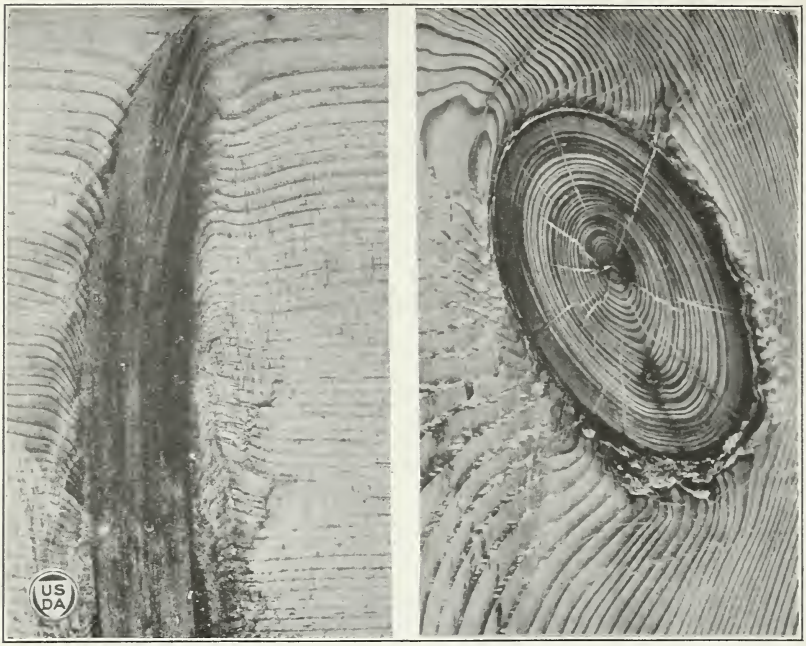


PIN KNOTS. SMALL KNOT.

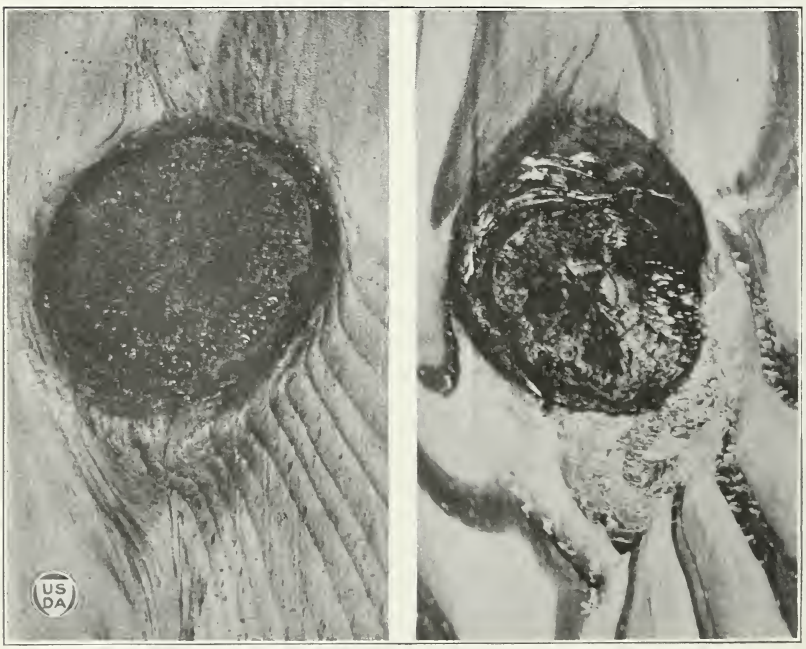


MEDIUM KNOT. LARGE KNOT. SOUND, INTERGROWN, ROUND, TIGHT, WATER-TIGHT.

DEFECTS FOUND IN YARD LUMBER.

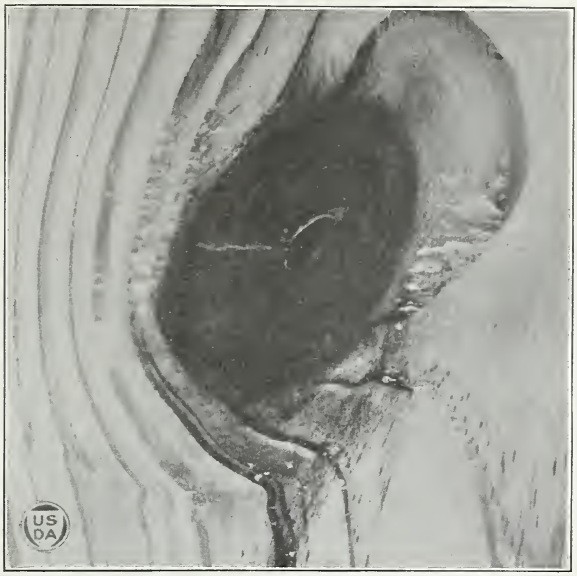


SPIKE KNOT. ENCASED KNOT. SOUND AND OVAL.



UNSOUND KNOT. DECAYED KNOT.

DEFECTS FOUND IN YARD LUMBER.



PITH KNOT.

HOLLOW KNOT.

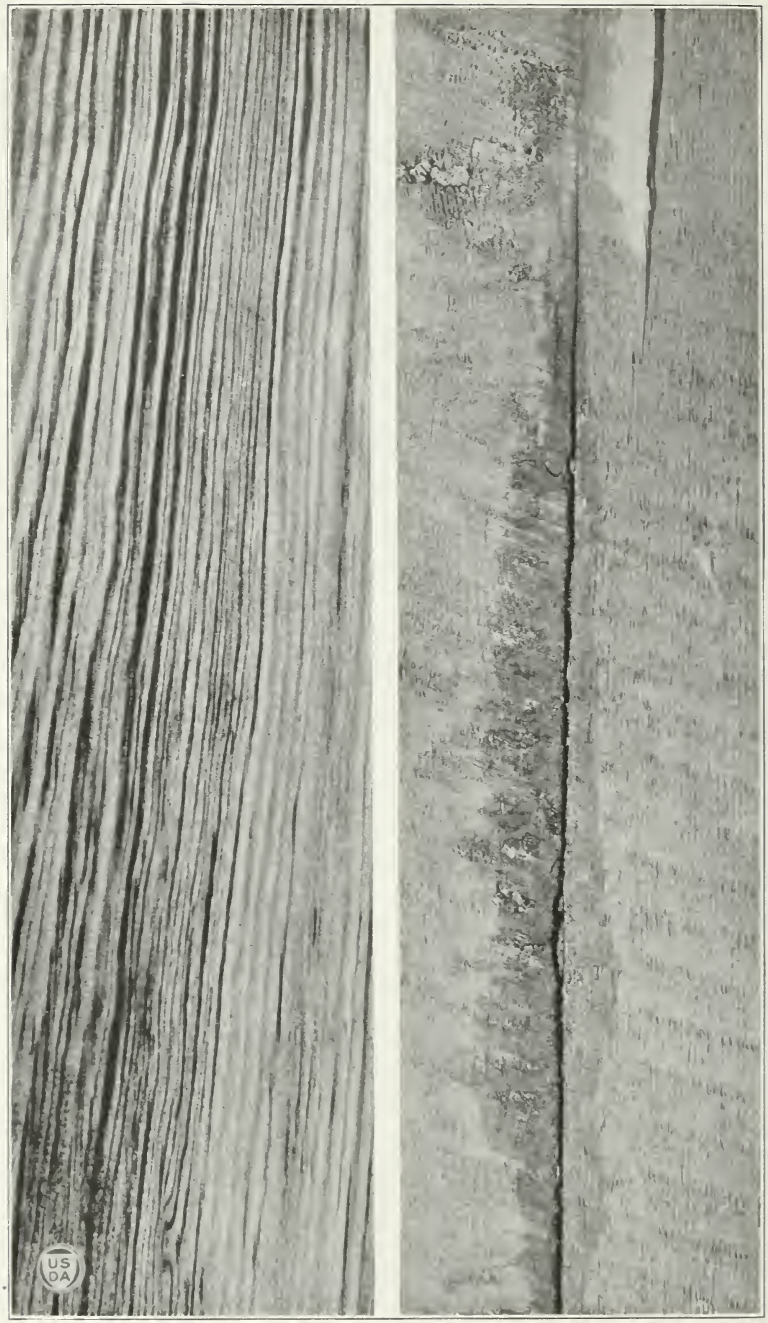
DEFECTS FOUND IN YARD LUMBER.

KNOT CLUSTER.

DEFECTS FOUND IN YARD LUMBER.

BRANCH KNOTS.

DEFECTS FOUND IN YARD LUMBER.



PITCH. PITCH SEAM (REDUCED IN SIZE).

DEFECTS FOUND IN YARD LUMBER.

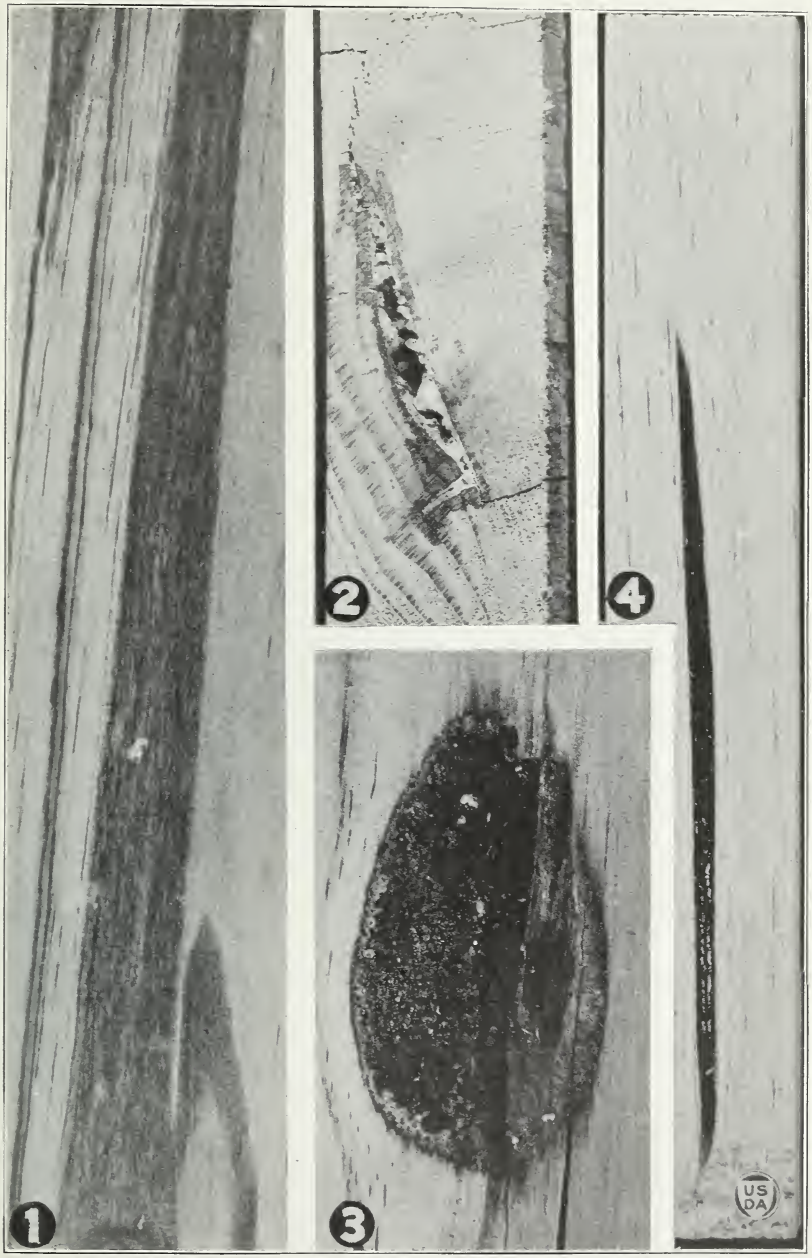
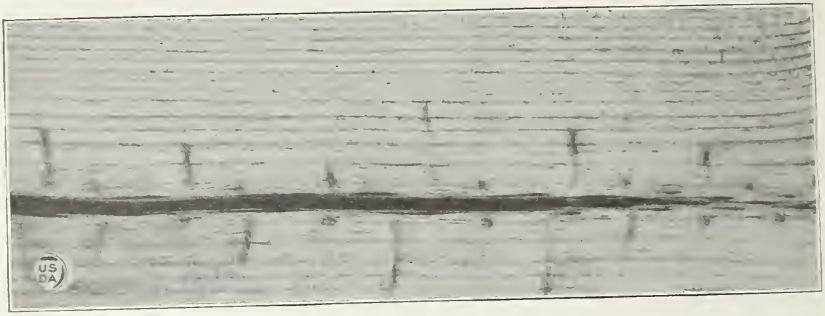
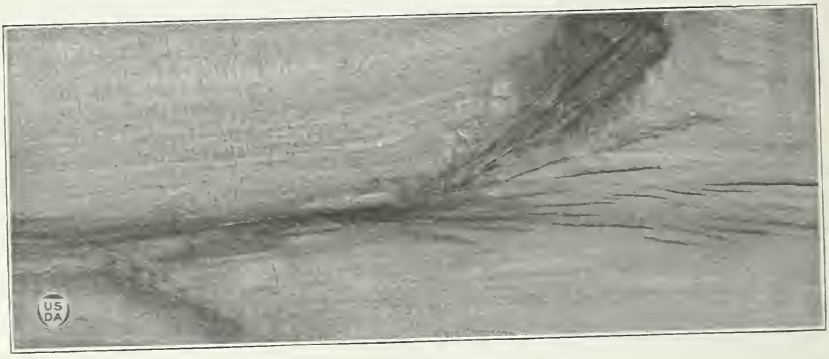


FIG. 1.—PITCH STREAK. FIG. 2.—PITCH POCKET (END VIEW). FIG. 3.—"SCAB" PITCH POCKET (FLAT-GRAINED LUMBER). FIG. 4.—PITCH POCKET (VERTICAL-GRAINED LUMBER).

DEFECTS FOUND IN YARD LUMBER.



PITH AND NEEDLE SCARS.



HEART CENTER.

PITH FLECKS.

DEFECTS FOUND IN YARD LUMBER.

FINE SHAKE. OPEN SHAKE. WANE.

DEFECTS FOUND IN YARD LUMBER.